ELECTRICAL EQUIPMENT SECTION

The Equipment pages comprise wiring diagrams, performance and adjustment data and trouble shooting instructions on the important Magnetos, special devices and complete electrical systems that have been adapted for automobile use.

Often special equipment is found on cars which was not factory installed. Such Equipment is fully covered in this section so that no trouble will be experienced in Service work.

New Equipment pages will be issued in every supplement. File them in the order of the page numbers at the end of this section.

ADLAKE

GENERATING AND LIGHTING SYSTEM

BATTERY.—Battery is 6 volt, 100-120 ampere-hour. The two-wire system is used.

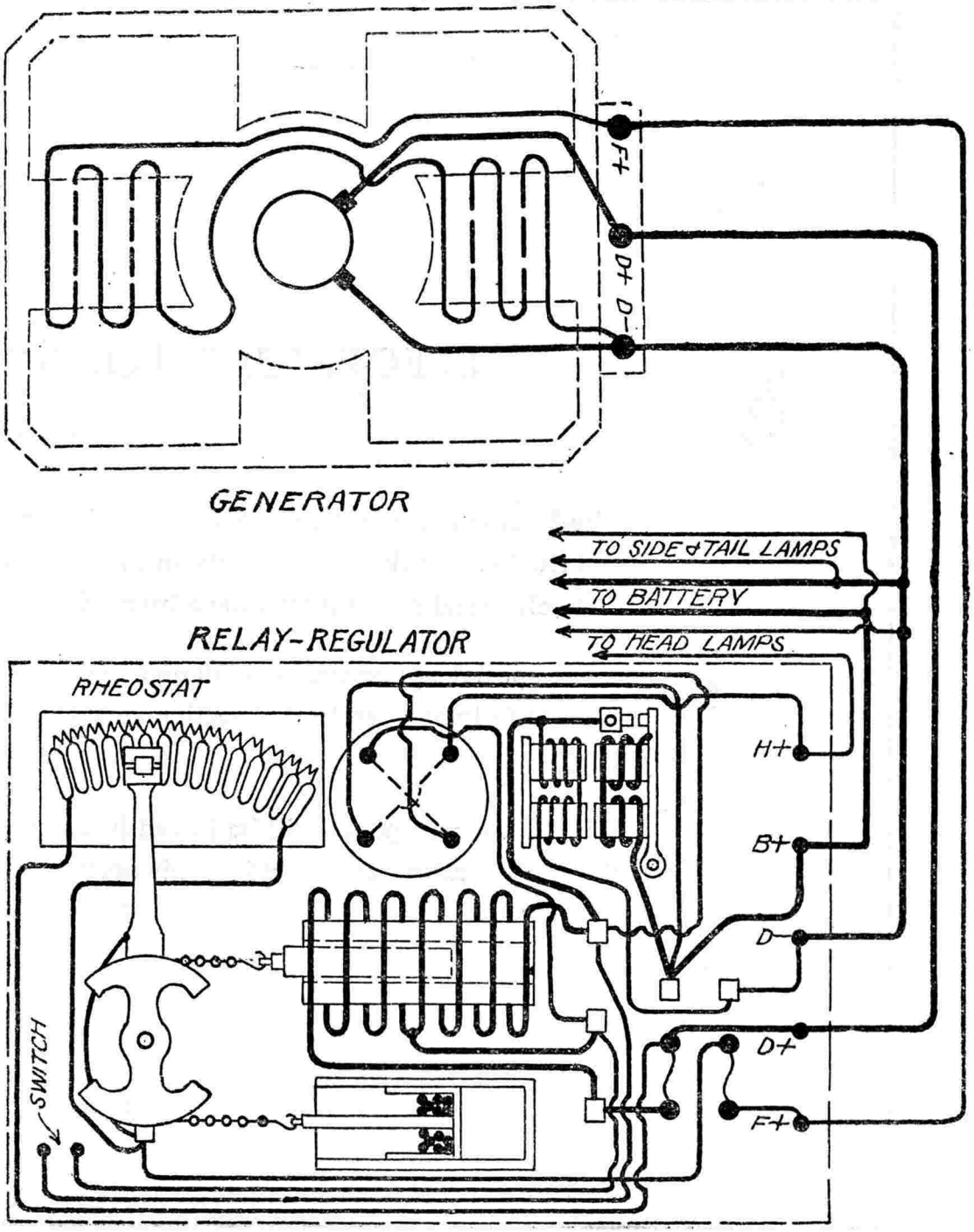
GENERATOR.—Generator current regulation is by an automatic field rheostat, operated by a solenoid connected in series with the charging circuit. Charging rate may be increased to meet winter driving conditions by pulling out the switch handle in the upper left-hand corner of the switch panel. Pulling out this switch short-circuits a part of the solenoid winding, retarding the action of the automatic rheostat and increasing the charging rate. Generator current ouput may be varied by changing the amount of bird shot in the piston of the dash pot. Maximum current output must not exceed 12 amperes.

OILING.—Pour 30 or 40 drops of light engine oil in the oil hole in the top of the generator every month. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

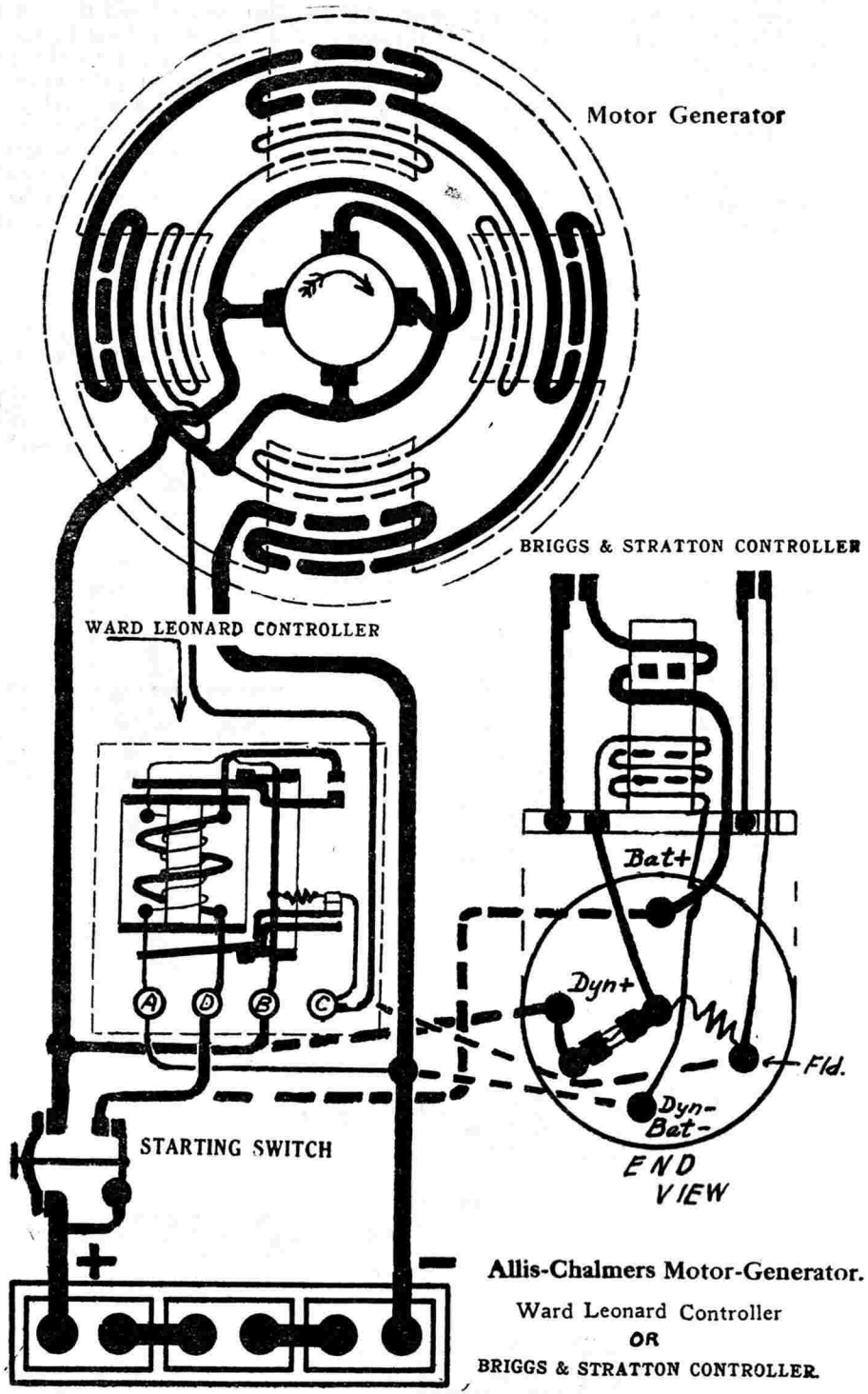
RELAY.—Relay closes at 8-10 miles per hour and opens at 6-8 miles per hour. Relay contacts separate 1/16 inch. The air gap beween the poles, contacts closed, is .015 inch. Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

REGULATOR, CARE.—Inspect and clean the regulator apparatus every month. Be careful not to alter the adjustment. Wipe the dash pot and piston with a cloth moistened with gasoline. Do not oil. Clean rheostat segments and spaces between them. Put one drop of light engine oil on the bearings of the pulley wheel.

FUSES.—Shunt field fuse is 5 ampere. Main circuit fuse is 15 ampere. Both are mounted in the instrument panel.



ADLAKE SYSTEM



Allis-Chalmers Motor-Generator.
Ward Leonard Controller
OR
BRIGGS & STRATTON CONTROLLER.

ALLIS-CHALMERS
GENERATING AND STARTING SYSTEM

BATTERY.—Battery is 6 volt, 80 ampere-hour. The positive (+) terminal is grounded.

STARTER-GENERATOR.—Model MG9-R or MG9-L. The unit is permanently chain connected to the engine crank shaft.

Starter Data

Torque	R.P.M.	Amperes	Volts
5 lb. ft.	570	120	5.7
10 lb. ft.	400	185	5.5
25 lb. f.	125	375	5.1
36 lb. ft.	Lock	475	4.7

GENERATOR.—The unit operates as a generator when driven by the engine. Generator output regulation is by vibrating regulator. Generator produces 6.6 volts, balancing the battery, at 1140 R.P.M. of the armature. Normal maximum charging rate is 10 amperes at 2000 R.P.M. of the armature or 20 miles per hour. The auxiliary contacts in the starting switch serve to disconnect the relay-regulator when the starting switch is depressed, protecting the relay windings.

OILING.—Put 2 or 3 drops of light engine oil in the starter-generator oilers every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles. Thoroughly clean out and repack the bearings with ball-bearing grease every year.

RELAY-REGULATOR.—Ward Leonard or Briggs-Stratton. Relay closes at 1140 R.P.M. of the armature or 10 miles per hour and opens at 1050-1100 R.P.M. of the armature or 8-9 miles per hour. Regulator is adjused to limit the charging rate to 10-12 amperes at all speeds above 2000 R.P.M. Adjustment of relay and regulator is made by bending the brass stops controlling the air gaps and spring tension. Clean relay and regulator contacts by drawing unglazed paper between them. If badly burned orpitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

ANTI-STALL

DESCRIPTION:—Anti-Stall is an automatic starting switch designed to start the automobile engine whenever the engine goes dead while the ignition switch is 'On'. It is an electrical device and draws current from the ignition line to operate an electro-magnetic starting switch and can be used on all cars with inertia principle starter pinion engagement. The starter switch is automatically opened when the engine begins to fire and the Anti-Stall remains inoperative until the engine stops.

INSTRUCTIONS:—To Start Engine. The spark, throttle and choke levers must be operated in the usual way. Turning on the ignition switch connects the Anti-Stall to the battery through the switch and it operates the starting switch cranking the engine. When the engine starts the Anti-Stall is automatically cut out without attention from the operator.

To Stop Engine. To stop the engine it is only necessary to cut off the ignition by turning the ignition switch to the 'Off' position. The Anti-Stall can not function with the switch off.

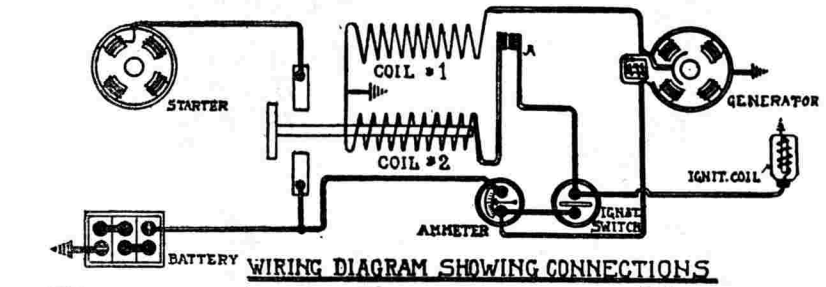
When Engine Stalls. If engine stalls with car at dead stop the clutch must be thrown out or the gear shift lever must be placed in neutral. If this is not done, the starter will move the car requiring a large current. This is the safety feature and will move the car from a dangerous position such as a railroad crossing. On cars with full manual advance where it is necessary to start with retarded spark, the spark lever must be retarded if the engine is cold. In actual use, the action of the Anti-Stall is so quick that there is no opportunity to retard the spark.

OPERATION:—With engine dead, Anti-Stall contacts (a) are normally closed. When the ignition is turned on current flows through the contacts and through coil (2). This is a solenoid with an iron core connected to the contactor in the starting switch. Movement of the contactor closes the starting switch contacts completing the starting circuit. The starter then cranks the engine. When the engine begins to fire the voltage built up in the generator causes a small current to flow through the coil (1). This attracts the contact armature drawing it toward the coil core and opening the contacts. When contacts open the circuit through coil (2) is broken. A spring then opens the starting switch contacts and the starter is thrown out of gear. On the new Model 6-V a vacuum piston operates an auxiliary arm which also opens the contacts providing a more positive operation at low speeds. As long as the engine is running, the generator voltage and the vacuum from the intake manifold hold the contacts open so that the starting switch can not operate or the starter gear mesh with the flywheel teeth.

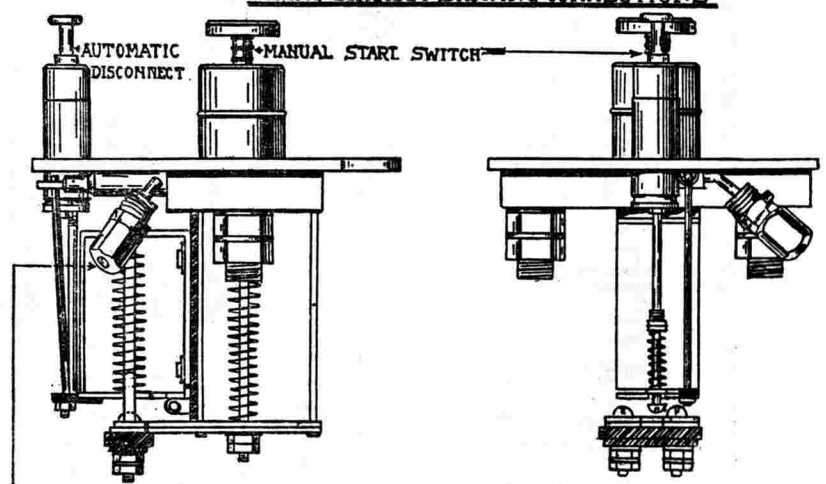
ADJUSTMENT:—On the model with generator control only, no adjustment is necessary. With vacuum models the suction from the intake manifold is controlled by a small screw in side of special 'T' used to connect vacuum line with vacuum tank or intake manifold. If starting motor cuts out before engine starts the vacuum is too great and must be cut down by turning the adjusting screw. If vacuum attachment does not cut off starter after engine starts the vacuum suction must be increased by backing off the screw slightly. The adjustment must be locked by tightening up the locknut.

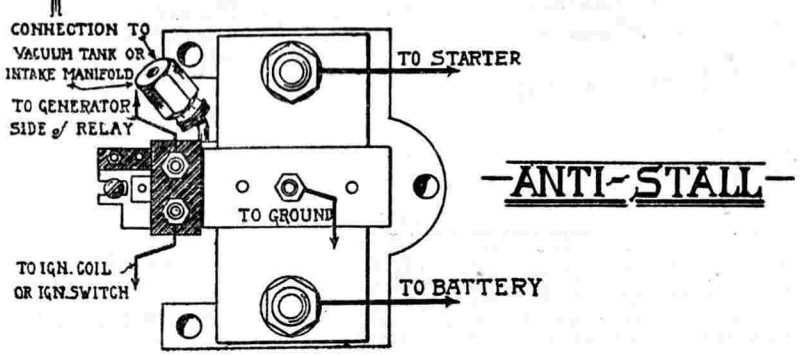
INSTALLATION:—The Anti-Stall can be mounted in any convenient position on the dash or the instrument board. The two buttons on the front of the device are designed for manual operation. The top button must be pulled out to render the automatic action inoperative. The lower button can then be used as an ordinary starting switch. These buttons are normally covered by nickel plated caps. When the Anti-Stall is mounted on a wood base the case must be grounded to the car frame by a wire connected to the ground terminal on the back of the case. This should be done wherever possible even on metal dash mounting to secure best results. In wiring the Anti-Stall regular starter cable should be used on the starting switch lines. A very satisfactory mounting is secured by leaving the car starting switch on the car and wiring the Anti-Stall starter switch across this so that the two switches are connected in parallel. This is shown in the sketch. A wire should be run from the Anti-Stall terminal marked 'IGN' to the ignition terminal on the switch or to the switch terminal of the ignition coil which is likely to be the most convenient mounting post. The 'GEN' terminal on the Anti-Stall must be connected to the generator side of the cutout relay. If the relay has two terminals connect the Anti-Stall line to the one from which the wire goes into the generator. If the relay has only one terminal outside the case which is connected to the ammeter the relay cover must be removed and the other terminal will then be visible. Make the connection and insulate the line so that the wire will not be shorted when the relay cover is replaced. On Westinghouse generators with the relay inside the generator endframe, it will be necessary to render the regular generator relay inoperative by positively closing the points and then intall a new relay outside from which the proper connections can be made. On cars without relays where the generator is connected directly to the switch, it will be necessary to install a relay. Make certain that the relay, when installed, is properly grounded.

Ford Installation. On Ford installations a special lighting switch must be installed to insure proper operation of Anti-Stall when car is run on magneto ignition. This switch is provided by Anti-Stall manufacturer.

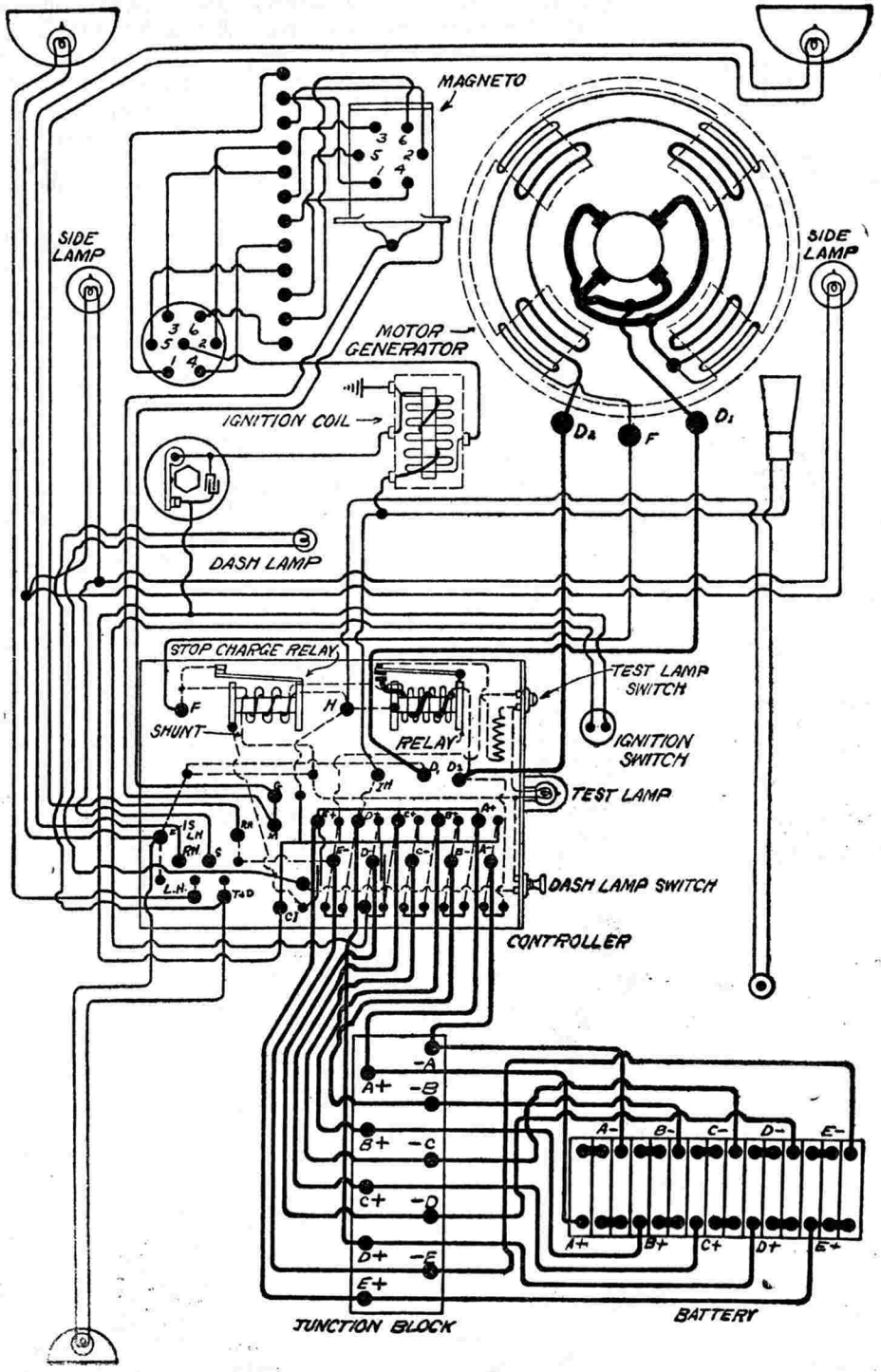


WIRING DIAGRAM SHOWING CONNECTIONS





ANTI-STALL



APELCO

6-30 VOLT GENERATING AND STARTING SYSTEM

BATTERY.—Battery is 30 volt, 20 ampere-hour. The two-wire system is used. The battery is divided into five sections of three cells and six volts each. The controller switch connects the five sections in series when in the "Start" position, providing 30 volts' pressure for operating the motor-generator as a starter to crank the engine. When the switch is in the "Run" position, the five sections of the battery are connected in parallel for charging.

MOTOR-GENERATOR.—Starter and generator are combined into one unit. The unit is permanently connected to the engine crankshaft. It is a four-pole, four-brush machine, each pole carrying a series and shunt winding. As a starter, the machine operates at 30 volts' pressure.

GENERATOR.—Generator voltage regulation is by vibrating regulator, known in this system as the "Stop Charge Relay". Maximum charging rate varies with the state of charge of the battery, reaching a maximum of 20 amperes with a low battery.

OILING.—Put 5 or 6 drops of light engine oil in each of the starter-generator oilers every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

RELAY AND REGULATOR.—Relay closes when the voltage of the generator reaches 6.5 volts and opens with a discharge current of 0-2 amperes. Regulator begins to operate at 8 volts, and maintains a constant voltage at that point. To adjust the relay and regulator, connect a voltmeter across the generator terminals and slowly speed up the engine. When the voltmeter indiceates 6.5 volts the contacts of the relay should close. If they do not, the relay requires adjustment. Relay adjusting screw must be turned in to increase the cut-in voltage, and out to decrease the cut-in voltage. Continue to increase the speed until the voltmeter indicates 8 volts. At this point, the movable contact arm of the regulator should commence to vibrate. Increase the speed of the engine and note if the voltage remains constant. If not, the regulator requires adjustment. If the regulator commenced to operate before 8 volts was reached, turn the adjusting screw in. If the voltage exceeded 8 volts, turn the adjusting screw out. A small pilot lamp on the top of the controller case glows until the relay closes. Clean relay contacts by drawing unglazed paper beween them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

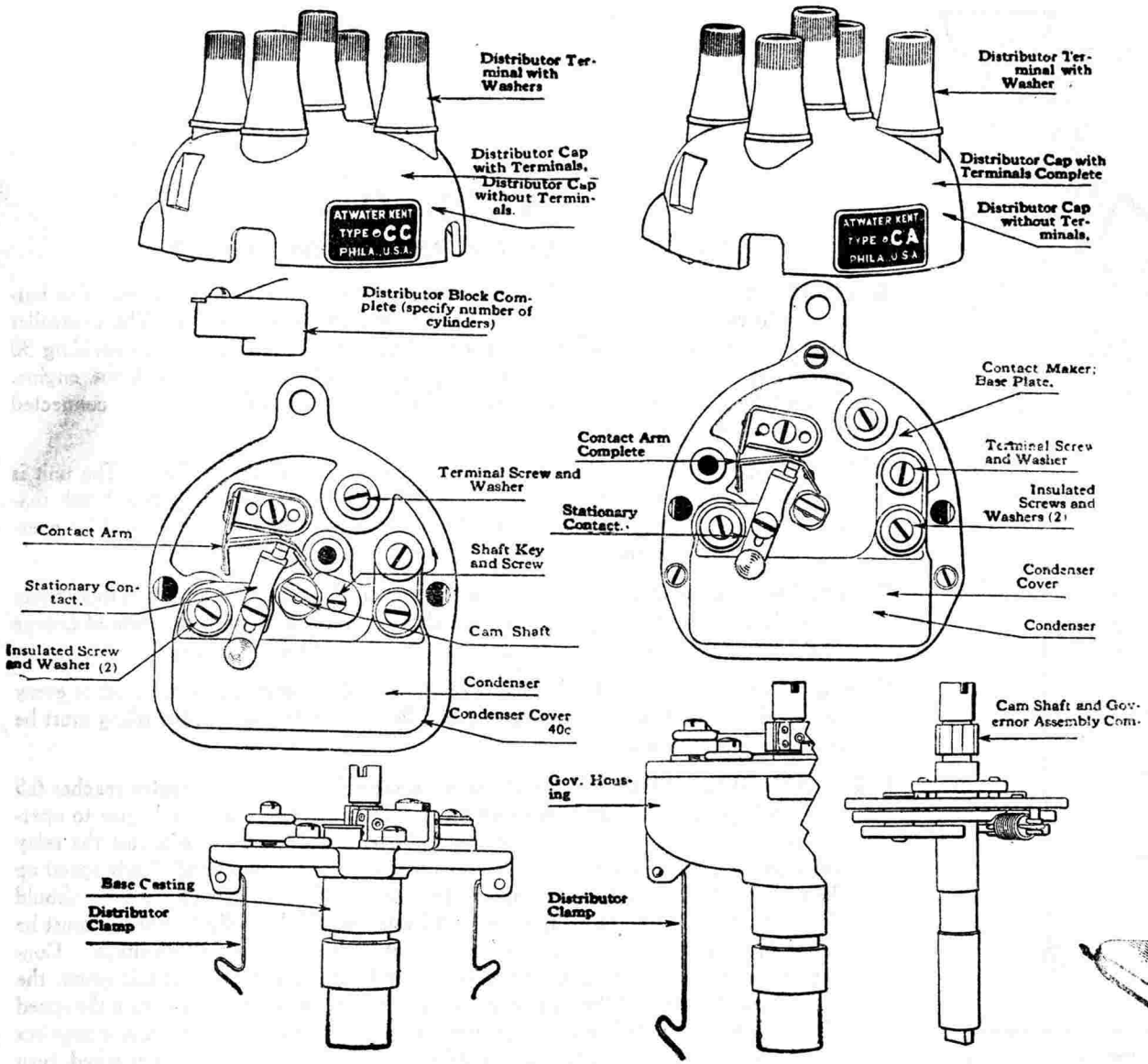


FIG. 1

Parts List—Type "CC"

FIG. 2

Parts of Governor Assembly not furnished separately

Parts List—Type "CA"

When any part of governor assembly is required, the repair station or factory will furnish complete governor assembly and housing. On receipt of new assembly return old assembly to nearest repair station or factory and you will receive credit for whatever parts can be used again.

In ordering new shafts or assemblies when old ones are not returned, specify make, model and year of car.

When ordering parts, order by name given here, specifying Type CC or Type CA, as required, and number of cylinders.

Types CC and CA

Types.—Types CC and CA Atwater-Kent systems are of the closed circuit type. Type CC is for manual advance. CA is for automatic advance.

Contacts.—Contacts should separate .005 inch to .008 inch. They are made of tungsten and will operate properly even though quite rough. Their natural color is dark gray, not silver. If badly burned or corroded, affecting the ignition, remove and clean by drawing across a piece of very fine emery cloth, laid on a flat surface, as on the bed of a drill press, resurfacing on a very hard oil stone. It must be remembered that even though very rough, tungsten contacts will operate properly, owing to the fact that the rough surfaces fit into each other perfectly.

Timing.—Type CC.—Turn engine until the piston entering power stroke is on top dead center. Place spark control lever one inch from the fully retarded position or as directed on other pages of this Manual (see page applying to car in question.) Then loosen control rod at breaker and turn breaker assembly back until contacts begin to separate and again connect control lever to advance lug on breaker assembly. Moving the spark control lever from the fully retarded to the fully advanced position should move the advance coupling lug on breaker assembly $\frac{7}{8}$ of an inch to 1 inch.

Type CA.—Turn engine until piston entering power stroke is on top dead center. If spark control lever is provided, place 1 inch from the fully rearded position, or as directed on another page of this Mannal (see page applying to car in question) and loosen control rod at breaker assembly advance lug. If no control lever is provided, loosen the locking device so that breaker assembly may be rotated. Then turn assembly back until contacts begin to separate. Then fasten the locking device to prevent breaker assembly turning or connecting the control rod to lug as the case may be. Moving of control lever from the fully retarded to the fully advanced position should move the advance lug $\frac{5}{8}$ of an inch to $\frac{3}{4}$ of an inch, when automatic advance is used also.

Condenser, Replacing of—To replace condenser, referring to Fig. 3, first put insulated washer (1) in place, next place condenser (2) in pocket, lay insulating washer (3) on top of condenser terminal (A) place condenser cover (4) in position, and put insulated screws (5 and 6) in. Then adjust contacts.

Oiling.—Put several drops of light engineoil in the oil hole, exposed when distributor cap is removed, every two weeks. At the same time put a very small amount of vaseline on the cam, applying with a toothpick. If car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

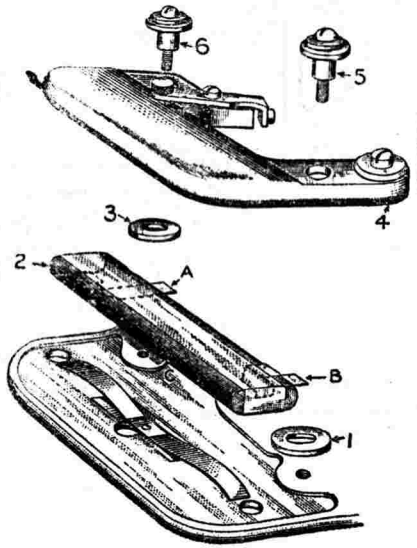


FIG. 3

Sequence of Operations in Installing Condenser

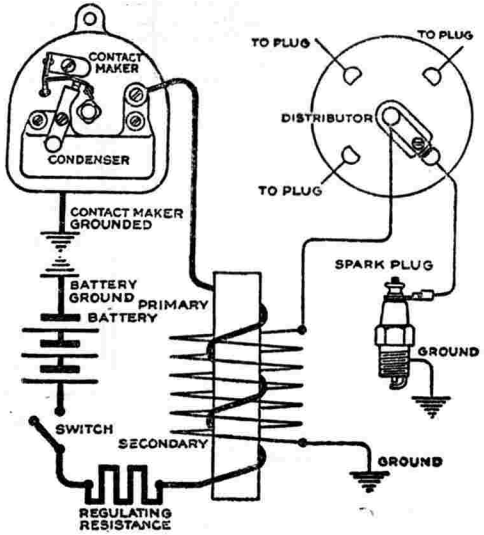


FIG. 4

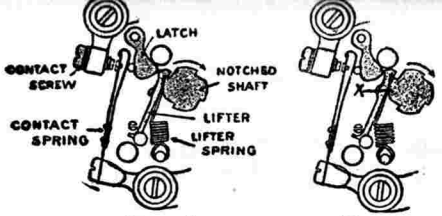


FIG. 1
Contact Open

FIG. 2
Contact Still Open

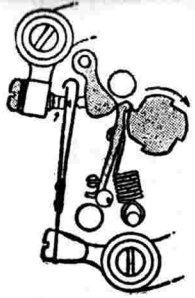


FIG. 3
Contact Made

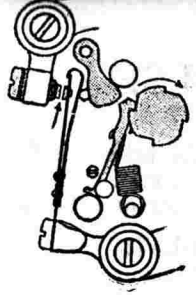


FIG. 4
Contact Broken

Atwater Kent Ignition

Types H, K2, K3

Types.—Type H is for manual advance. Type K2 is for automatic advance. Type K3 is for combined manual and automatic advance.

Operation.—Referring to Figs. 1, 2, 3 and 4, the notched shaft has one notch for each cylinder, the one shown being for a four cylinder engine. As the shaft rotates the hook on the end or the lifter catches in the notch as shown in Fig. 1, pulling the lifter up until the points marked "X," Fig. 2 come together, This causes the catch to be forced out, releasing it. When latch is released, the spring pulls it back. As it is pulled back, it strikes the catch and closes the contacts as shown in Fig. 3. As it moves farther, the latch is released and allows the contacts to be separated as shown in Fig. 4 and the above operation is repeated. As the action is so rapid as to be almost imperceptible to the eye, many people suspect the contacts of not making connection. To test this, hold the lifter from springing back when it is released by the shaft, and allow it to come back slowly. The contacts will then be seen to close if adjusted properly. Do not test contacts with a screw driver or other piece of metal. To do so may heat and take the temper out of the spring.

Contacts.—Contacts should separate .010 inch to .012 inch. They are made of tungsten and will operate properly even though rough, due to the fact that the surfaces fit each perfectly. Their natural color is dark grey, not silver. If burned or corroded, affecting the ignition, remove them and clean by drawing across a piece of fine emery cloth, laid on a flat surface, as on the bed of a drill press, finishing on a very hard oil stone.

Timing.—To time breaker to engine, turn engine until piston entering power stroke is on top dead center, spark control lever one inch from the fully retarded position or as directed on another page of this Manual. (See page applying to car in question.) Then loosen control rod at advancing control lug on breaker assembly on cars using manual control, or loosen locking device, so that assembly may be turned, on cars having automatic control only. Then turn assembly back slowly until a click is heard. Stop immediately, connect control rod or secure locking device, to hold breaker in this position.

Spark Plug Gaps.—Spark plug gaps should be .025 inch to .031 inch, depending on the engine upon which it is used.

Oiling.—Put a drop of light machine oil in each of the 3 points marked in Fig. 5 and put 4 or 5 drops of light machine oil in the oil hole beside the notched shaft, every two weeks. Put a very small amount of vaseline on the notched shaft, applying with a toothpick, at the same time. If car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

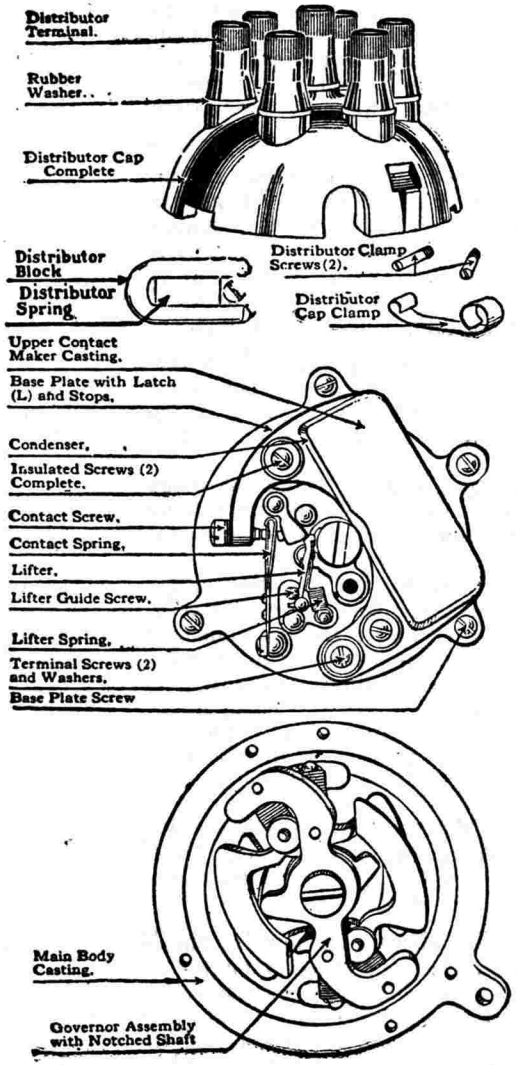


FIG. 7
Parts List, Type K3

Order parts by name given here, specifying type and number of cylinders.

:—If in need of notched shaft or any parts for governor a ly, order complete governor from nearest jobber or from factory direct, and on receipt of new governor return old governor to factory for inspection, and you will receive credit for parts that can be used again.

If you are in need of the latch or any of the pins for the contact maker plate, order the plate with these parts attached,

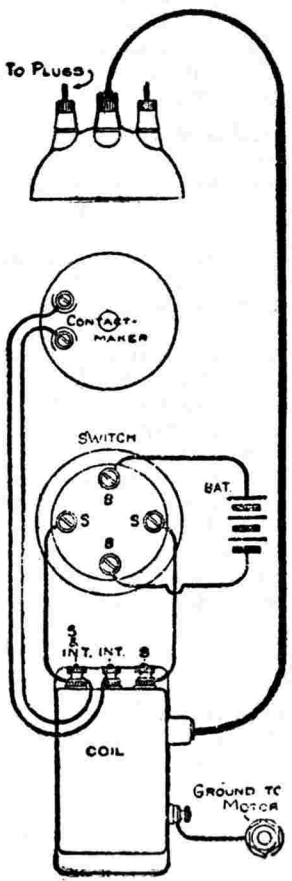


FIG. 8
Wiring Diagram, Type H

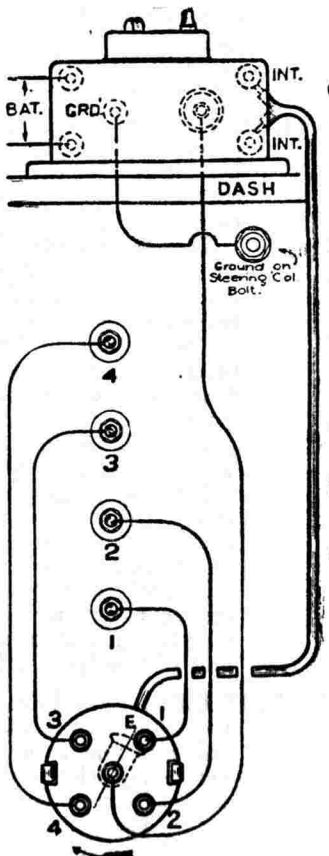
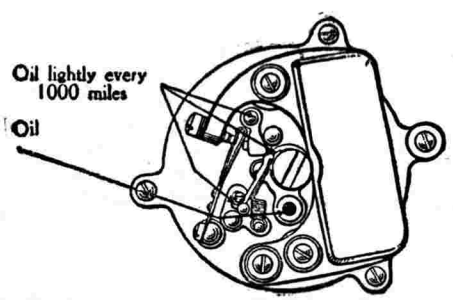
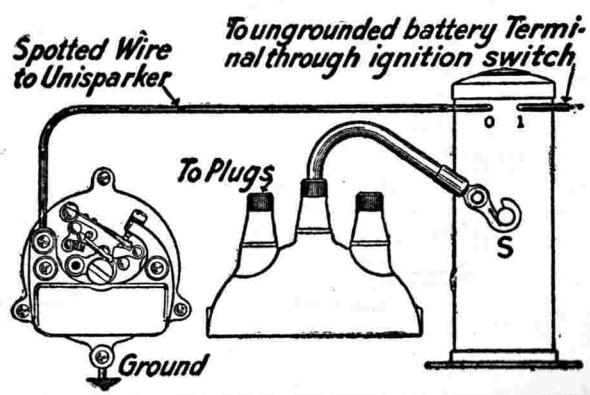


FIG. 9
Diagram of Wiring
Type K2
Ford System





AUTOPULSE

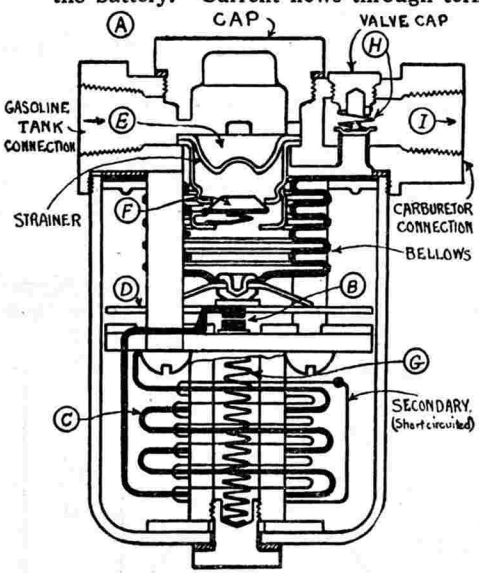
Electrical gasoline pumps have recently been placed on the market for installation on automobiles. These are designed to pump gasoline from the tank located at the rear of the car below the level of the carburetor to the carburetor float chamber. When used they displace the air pressure or vacuum systems which have been used for this purpose. They will be found installed as standard equipment on several passenger car models.

AUTOPULSE.

DESCRIPTION:—The Autopulse consists of a bellows pump operated by a new design electric motor. The bellows are made of metal with reinforced and soldered flanges and it is claimed that they will outlast the ordinary life of an automobile engine. No lubrication or service adjustments are necessary.

INSTALLATION:—The pump should be mounted as near the carburetor as is practical and approximately on the same level. Wherever possible mount the pump directly on the carburetor bowl. Both suction and delivery lines of the pump are tapped with 1/8 inch standard pipe thread and suitable fittings are provided for mounting. For mounting on chassis or engine special brackets 266 (for horizontal mounting) or 267 (for vertical mounting) are provided. The pump should not be mounted on a wood dash as this will tend to amplify the sound of operation. For single unit mounting where less than 5 gallons per hour is desired use 1/4 inch tubing for all connections. If full capacity is desired use 5/16 inch tubing. For Duplex or two unit installation, use 1/8 or 1/4 inch pipe thread manifolds. On Triplex or Quad installations use two 5/16 inch tubes or one 1/8 inch tube with 1/4 inch pipe thread manifolds. On Quintette or Sextette installations use two 3/8 inch tubes with 1/4 inch pipe thread manifolds. On multiple installations each unit operates independently and is connected in parallel with the others. Connect the flexible lead to the ignition terminal on the switch or to the switch terminal on the ignition coil. The pump is grounded through the shell. On two wire systems or where pump is mounted on insulated base, the mounting bracket must be connected to the battery or grounded to the engine block.

OPERATION:—When the ignition switch is turned on the pump is connected to the the battery. Current flows through terminal 'A' to contacts 'B' which are normally closed when pump is on suction stroke. The current then flows through coil 'C'. This causes the coil to pull armature 'D' downward expanding the metal bellows and drawing gasoline from the storage tank through the inlet passage 'E' and suction valve 'F' into the bellows chamber. During the suction stroke the contacts are kept closed by the magnetic action of a steel sleeve in the coil which tends to move upward stressing the spring under the lower contact and holding the contacts closed. When the armature hits the spring the contacts open. Arcing of the contacts is prevented by a special short-circuited secondary winding which sets up a current opposite to that of the primary when the primary circuit is broken. This eliminates arcing. The opening of the contacts completes the suction stroke and the spring 'G' then forces the armature upward collapsing the bellows. Suction valve 'F' closes and the gasoline in the bellows is forced through check valve 'H' and delivery passage 'I' to the float chamber of the carburetor. When the delivery stroke is completed contacts 'B' close and the cycle is repeated.



REGULATION:—The operation of the pump is controlled entirely by the hydraulic pressure of the gasoline in the float chamber of the carburetor. When the float valve closes with the float chamber filled with gasoline the hydraulic pressure in the line prevents the pump completing its delivery stroke and the contacts remain open. The pump thus remains inoperative until gasoline is drawn from the carburetor float chamber and does not draw any current even though the ignition switch is on. The pump can only operate while the engine is running unless there is a leak in the line.

CAPACITY:—The Autopulse draws .25-.5 amperes at 6 volts when operating at full capacity. It is normally rated at 5 gallons per hour but will pump 7-8 gallons at full load. On larger engines or where a very even flow of gasoline is desired two, three, four, five or six units may be operated in parallel on the same feed and delivery lines. In this case each unit operates independently. A five unit or Quintette installation will pump 35-40 gallons per hour drawing approximately 2 amperes at 6 volts. Other units are designed for 12 and 32 volt installation.

TROUBLE SHOOTING:—Installation Test. When installing pump partially drain carburetor bowl. Then close ignition switch but do not crank engine. The pump will operate at high speed for several seconds and should then stop. If pump continues to operate at slow speed this is an indication of leakage in the suction or delivery lines.

Test for Gasoline Leakage. This is indicated by continued action of pump with engine stopped and with ignition switch on. Check carburetor for leaking float valve and check delivery line for poor connections. Then check pump for leaking suction valve.

Test for Air Leakage. This is indicated by noisy or uneven operation of the pump. Crank engine and allow it to idle. The pump should operate uniformly. If it speeds up or is noisy, turn ignition switch on after engine has been standing for several seconds but do not crank engine. If there is air in the suction line the pump will vibrate without pumping even after the carburetor chamber is full. The gasoline tank must be full in making this test.

Test for Clogged Line. With pump operating and engine idling watch the dash ammeter. The pump normally draws 1/2 ampere which may not be noticeable on dash ammeter. If needle vibrates noticeably with each stroke check the gasoline line for clogged openings and clean all screens.

Multiple units should be tested individually by disconnecting lead wires and connecting one unit in the circuit at a time. Actual capacity of unit can be tested by placing container under delivery port and turning on ignition switch. The unit will pump at full capacity until the switch is turned off.

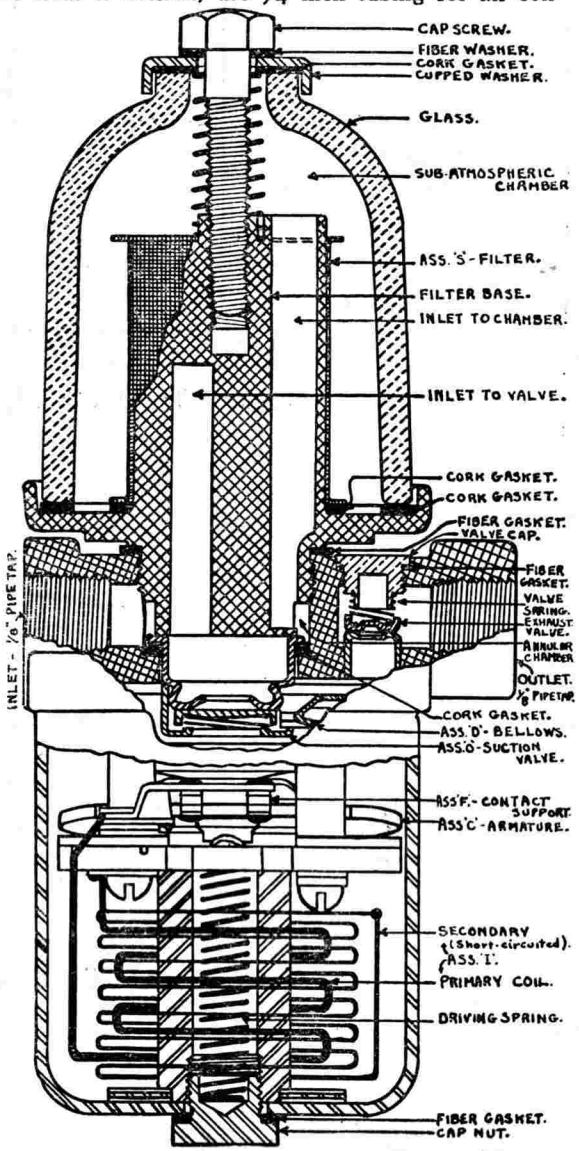
SERVICING:—The large filter screen in the air chamber above suction valve should be cleaned when the test indicates a clogged line. Remove the cap on top of unit and remove screen for cleaning. In replacing, carefully shellac cap gasket before replacing cap. If the suction valve has been removed, replace spring in pronged cap with small hole up and replace valve inserting the valve boss in the hole. The polished side must be up. Make certain that cork gasket is in place and snap cap over end of valve cage. The cap must be tight.

SEDIMENT TRAP:—A special sediment trap has been designed for mounting on delivery side of pump. It is fitted with a fine mesh brass screen and separates water and sediment from the gasoline. It also acts as an expansion chamber assuring an even flow of gasoline to the carburetor. The pump may be mounted directly on the side of the sediment trap.

AUTOPULSE—New Model

DESCRIPTION:—The Autopulse consists of a bellows pump operated by a new design electric motor. The bellows are made of metal with reinforced and soldered flanges and it is claimed they will outlast the ordinary life of an automobile engine. No lubrication or service adjustments are necessary.

INSTALLATION:—The pump should be mounted as near the carburetor as is practical and approximately on the same level. Wherever possible mount the pump directly on the carburetor bowl. Both suction and delivery lines of the pump are tapped with ⅛ standard pipe thread and suitable fittings are provided for mounting. For mounting on chassis or engine special brackets 266 (for horizontal mounting), or 267 (for vertical mounting) are provided. A special rubber insulated bracket is supplied for mounting on wooden dash to eliminate sound. For single until mounting where less than 5 gallons per hour is desired, use ¼ inch tubing for all connections. If full capacity is desired, use 5/16 inch tubing. For Duplex or two unit installation, use ⅛ or ¼ inch pipe thread manifolds. On Triplex or Quad installations, use two 5/16 inch tubes or one ⅜ inch tube with ¼ inch pipe thread manifolds. On Quintette or Sextette installations, use two ⅜ inch tubes with ¼ inch pipe thread manifolds. On multiple installations each unit operates independently and is connected in parallel with the others. Connect the flexible lead to the ignition terminal on the switch or to the switch terminal on the ignition coil. The pump is grounded through the shell. On two wire systems or where pump is mounted on insulated base, the mounting bracket must be connected to the battery or grounded to the engine block.



OPERATION:—Pump is connected to the battery when the ignition switch is turned on. Current flows from terminal on side of case through primary winding to contacts which are normally closed on suction stroke and grounds through case. The coil draws the armature downward expanding the bellows chamber and draws gasoline from tank through inlet to filter chamber then through filter screen and suction valve to bellows chamber. During suction stroke contacts are kept closed by action of steel sleeve in the coil which stresses the spring under the lower contacts. When the armature hits the spring the contacts open and primary circut is broken. A special design short circuited secondary coil prevents arcing at the contacts. The driving spring in the coil core then forces the armature upward collapsing the bellows and forcing the gasoline through the check valve and outlet passage to the carburetor bowl. When the delivery stroke is completed, contacts close and Autopulse repeats suction stroke.

REGULATION:—The operation of the pump is controlled entirely by the hydraulic pressure of the gasoline in the float chamber of the carburetor. When the float valve closes with the float chamber filled with gasoline the hydraulic pressure in the line prevents the pump completing its delivery stroke and the contacts remain open. The pump thus remains inoperative until gasoline is drawn from the carburetor float chamber and does not draw any current even though the ignition switch is on. The pump can only operate while the engine is running unless there is a leak in the line.

CAPACITY:—The Autopulse draws .25-.5 amperes at 6 volts when operating at full capacity. It is normally rated at 5 gallons per hour but will pump 7-8 gallons at full load. On larger engines or where a very even flow of gasoline is desired two, three, four, five or six units may be operated in parallel on the same feed and delivery lines. In this case each unit operates independently. A five unit or Quintette installation will pump 35-40 gallons per hour drawing approximately 2 amperes at 6 volts. Other units are designed for 12 and 32 volt installation.

TROUBLE SHOOTING:—Installation Test. When installing pump, partially drain carburetor bowl. Then close ignition switch but do not crank engine. The pump will operate at high speed for several seconds and should then stop. If pump continues to operate at slow speed this is an indication of leakage in the suction or delivery lines.

Test for Gasoline Leakage. This is indicated by continued action of pump with engine stopped and with ignition switch on. Check carburetor for leaking float valve and check delivery line for poor connections. Then check pump for leaking suction valve.

Test for Air Leakage. This is indicated by noisy or uneven operation of the pump. Crank engine and allow it to idle. The pump should operate uniformly. If it speeds up or is noisy, turn ignition switch on after engine has been standing for several seconds but do not crank engine. If there is air in the suction line the pump will vibrate without pumping even after the carburetor chamber is full. The gasoline tank must be full in making this test.

Test for Clogged Line. With pump operating and engine idling watch the dash ammeter. The pump normally draws ½ ampere which may not be noticeable on dash ammeter. If needle vibrates noticeably with each stroke check the gasoline line for clogged openings and clean all screens. **Multiple units** should be tested individually by disconnecting lead wires and connecting one unit in the circuit at a time. Actual capacity of unit can be tested by placing container under delivery port and turning on ignition switch. The unit will pump at full capacity until the switch is turned off.

SERVICING:—If Autopulse fails to pump with carburetor bowl empty, and pump properly connected and grounded, check outlet valve by raising valve off seat and rotating with a pen knife inserted through outlet passage. Then blow through pump from inlet side. If obstructed take off filter base and press gently on suction valve to test for gummed seat. To assemble suction valve after removal, place spring in retainer with small hole up. Place valve over spring, polished side up, with boss on lower side of valve in hole on spring. Then snap retainer over valve cage and replace in chamber with cork gasket under cage flange. The delivery valve screw should not be removed as valve can be checked through outlet passage.

FILTER:—A fine mesh screen filter is enclosed in the glass chamber on top of the unit. To remove filter, take out cap screw and lift off glass cover. The filter screen can then be cleaned.

BERLING MAGNETO

TWO SPARK DUAL, TYPES DD-44, DD-66 AND DD-88

BREAKER.—Breaker contacts separate .016 to .020 inch. They are made of platinum. When the condition of the points affects the ignition, resurface with a fine flat jeweler's file or worn No. 00 sandpaper. See that the brush in the back of the breaker base makes good contact with the surface on which it rubs.

OILING.—Put 10 drops of light engine oil in each oil cup every month. Put a small amount of vaseline on the cams and on the two rubbing surfaces of the fiber lever, applying with a toothpick. If the car is driven more than 1000 miles in a month, these attentions must be given every 1000 miles.

TIMING.—Turn the crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Then remove the distributor block and turn the armature shaft until the distributor brush is in such a position that it will make contact with No. 1 segment when the block is replaced. Place the breaker housing in the fully retarded position by turning it as far as it will go against the direction of rotation of the armature. Then turn the shaft very slightly in either direction until the magneto breaker contacts just begin to separate. Couple the magneto to the engine, being careful to maintain the exact position of the armature. The battery breaker contacts separate 10 degrees later than the magneto breaker contacts.

SPARK PLUG GAPS.—Spark plug gaps are .020 to .030 inch.

COIL.—Type VN. The coil is of the vibrator type, giving a shower of sparks during the interval that the battery breaker contacts are separated.

SWITCH.—Type SW. The connections in the switch for the three positions of the switch handle are as follows:

"Off" Position.—"MP" connected to "G". "B" open. "D" connected to "MS".

"Batt" Position.—"B" connected to "G". "CS" connected to "D". "MS" connected to "MP".

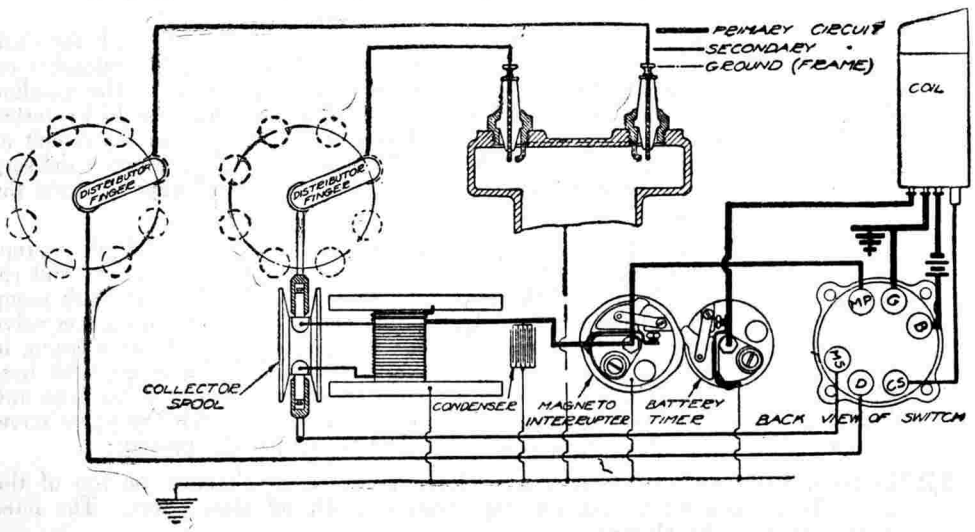
"Mag" Position.—"MP" open. "B" open. "CS" open. "MS" connected to "D". "G" open.

COMBINED COIL AND SWITCH.—Type SC. The connections in the switch for the three positions of the switch handle are as follows:

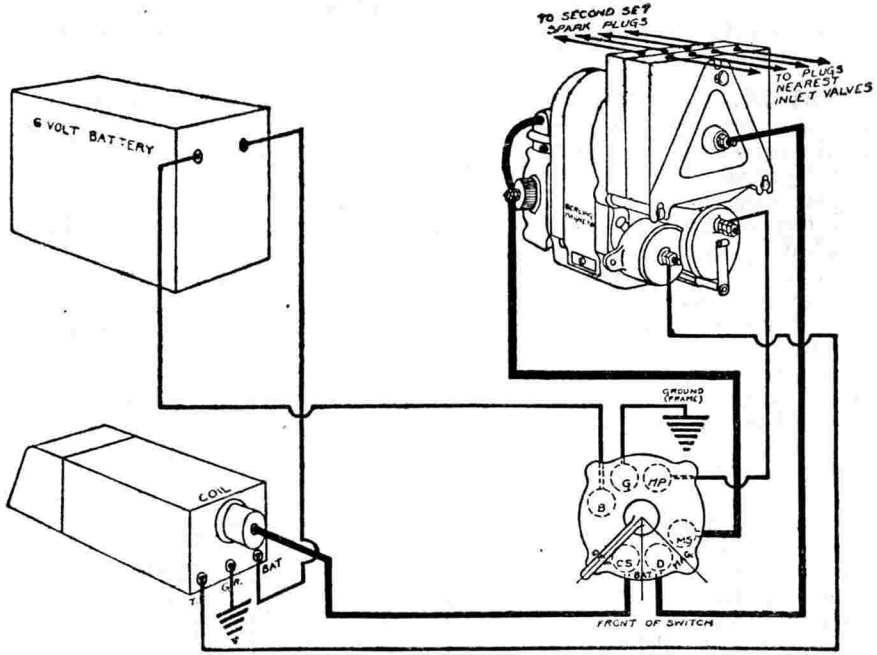
"Off" Position.—"MP" connected to "GR". "B" open. "D" connected to "MS".

"Batt" position.—"MP" connected to "GR". Primary winding of coil connected between "B" and "T". Secondary winding of coil connected between "D" and "GR".

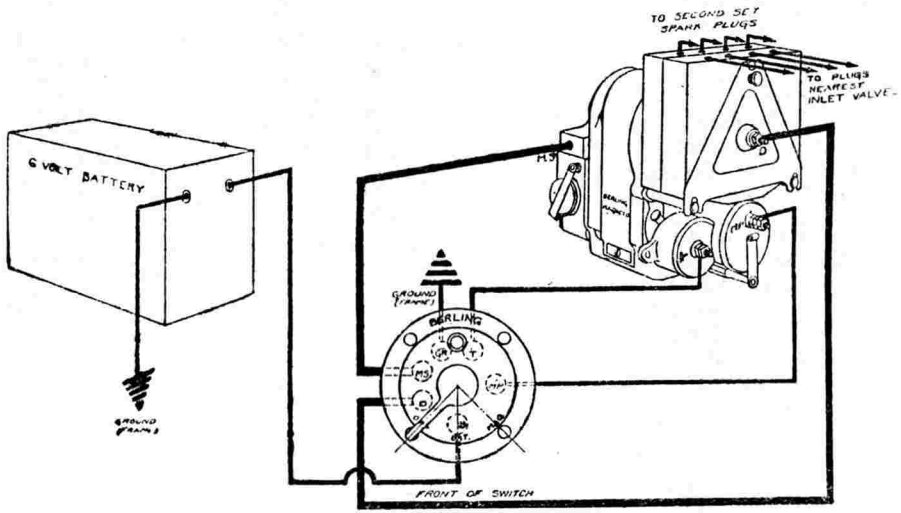
"Mag" Position.—"MP" open. "B" open. "D" connected to "MS".



Internal Circuits of Type DD Magneto



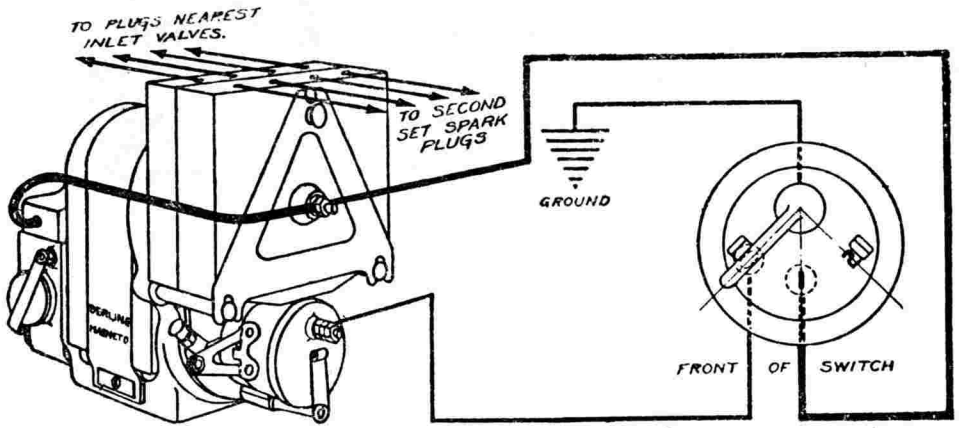
Type DD Magneto, Type VN Coil, Type SW Switch



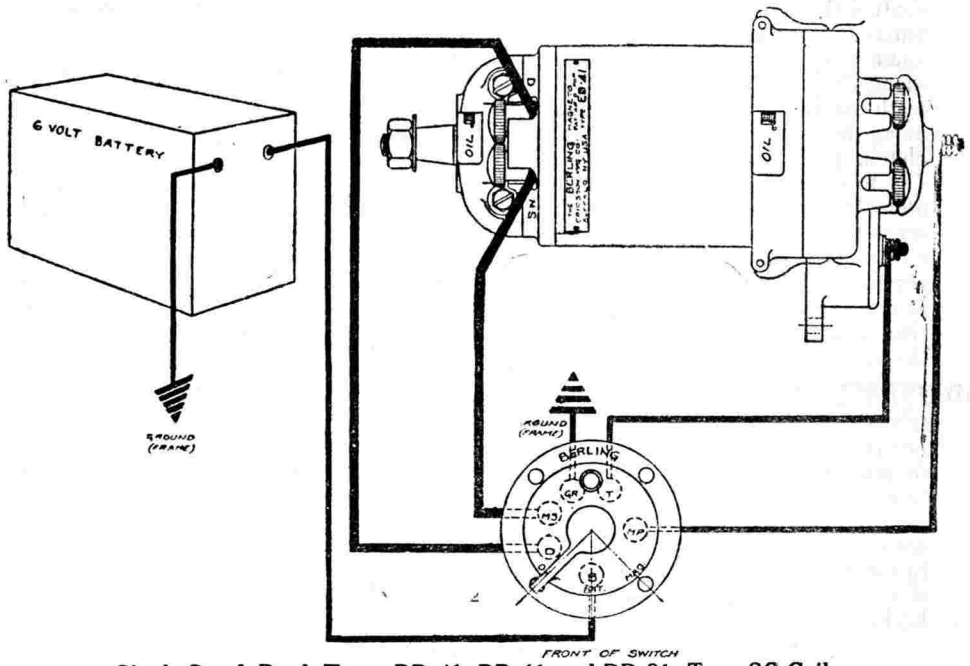
Type DD Magneto, Type SC Combined Coil and Switch

BERLING MAGNETO

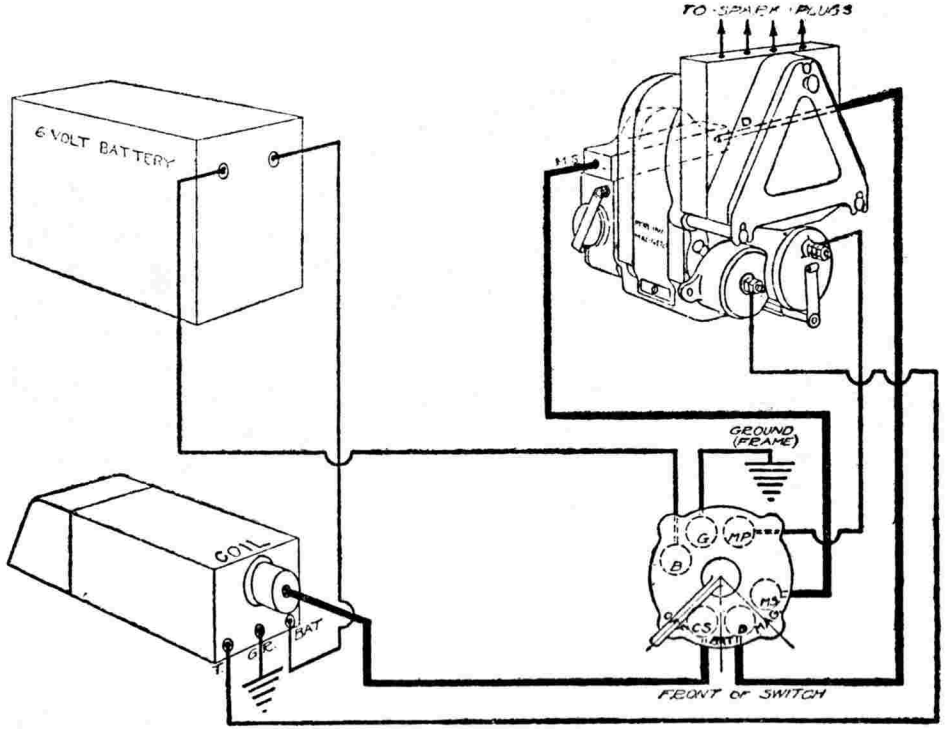
SINGLE SPARK DUAL, TYPES ED-41, DD-41, DD-61 AND DD-81
TWO SPARK INDEPENDENT, TYPES D-44, D-66 AND D-88



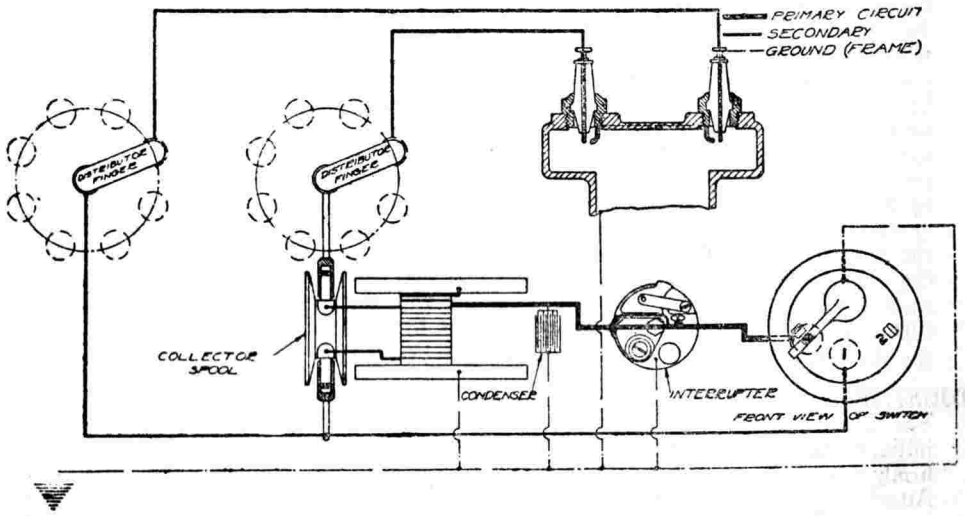
Single-Spark Dual, Type ED-41, Type SC Coil



Single-Spark Dual, Types DD-41, DD-61 and DD-81, Type SC Coil



Two-Spark Independent. Types D-44, D-66 and D-88.



Internal Circuits of Two-Spark Independent Type

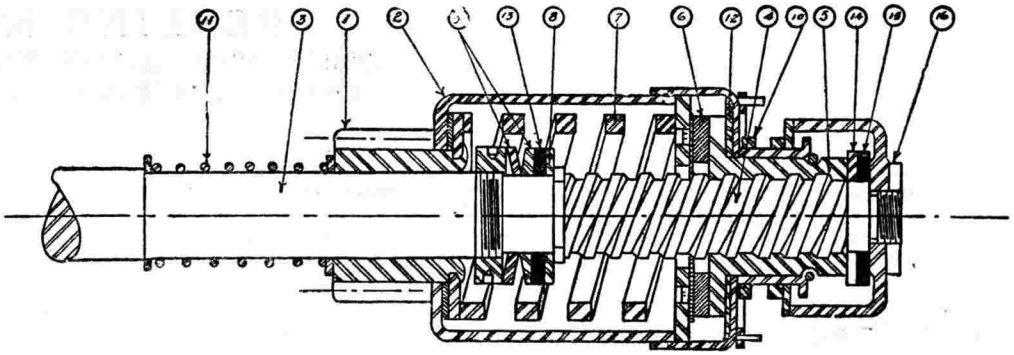
BIJUR

AUTOMATIC PINION SHIFT

DIRECT ACTING TYPE

OPERATION.—The pinion (1) is driven by notches in the barrel (2), but is free to move along the shaft (3). When the starting switch is closed, the turning of the motor shaft (3) causes the nut (5) to screw itself to the left. The nut (5) drives the barrel (2) and pinion (1) through the clutch (6). The clutch member (6) is pressed against the face of the nut (5) by the spring (7). As the entire assembly moves along the shaft toward the left, the pinion will mesh with the flywheel gear if the teeth are in proper position. Should the teeth strike, the nut (5) continues to move along the shaft, compressing the spring (7), which in turn increases the friction of the clutch. (6). This causes the pinion to be turned, allowing the compressed spring (7) to snap the pinion into mesh with the flywheel gear. As the nut moves further along the shaft, the clutch plate comes in contact with the washer (8). As the nut tends to move further, and the clutch plate can move no further, the friction of the clutch increases greatly, causing the pinion to be turned, cranking the engine. The slipping of the clutch and the compressing of the disked washers relieve the shocks of starting. As the engine picks up, the overrunning effect reverses the above operations and throws the pinion out of mesh. The spring (10) receives the shock when the gears are thrown out.

ADJUSTMENT AND CARE.—The clearance between the pinion and the flywheel gears, when in the fully demeshed position, must always be 3/8 inch. To test shift, run the barrel along the shaft by hand to see that it turns freely. Sufficient lubrication (oil or graphite) must always be on the shaft (4) between washers 8 and 13 and between washers 14 and 15. To determine the initial torque of the clutch, fit a brake over the pinion (1) with a lever 1 foot long. Hold the armature shaft from turning with a wrench applied on the hexagon nut at commutator end. Attach a spring scale to the free end of the lever and determine the pull necessary to cause the clutch to slip. The pull required must be not less than 4 1/2 to 5 pounds and not more than 12-15 pounds.

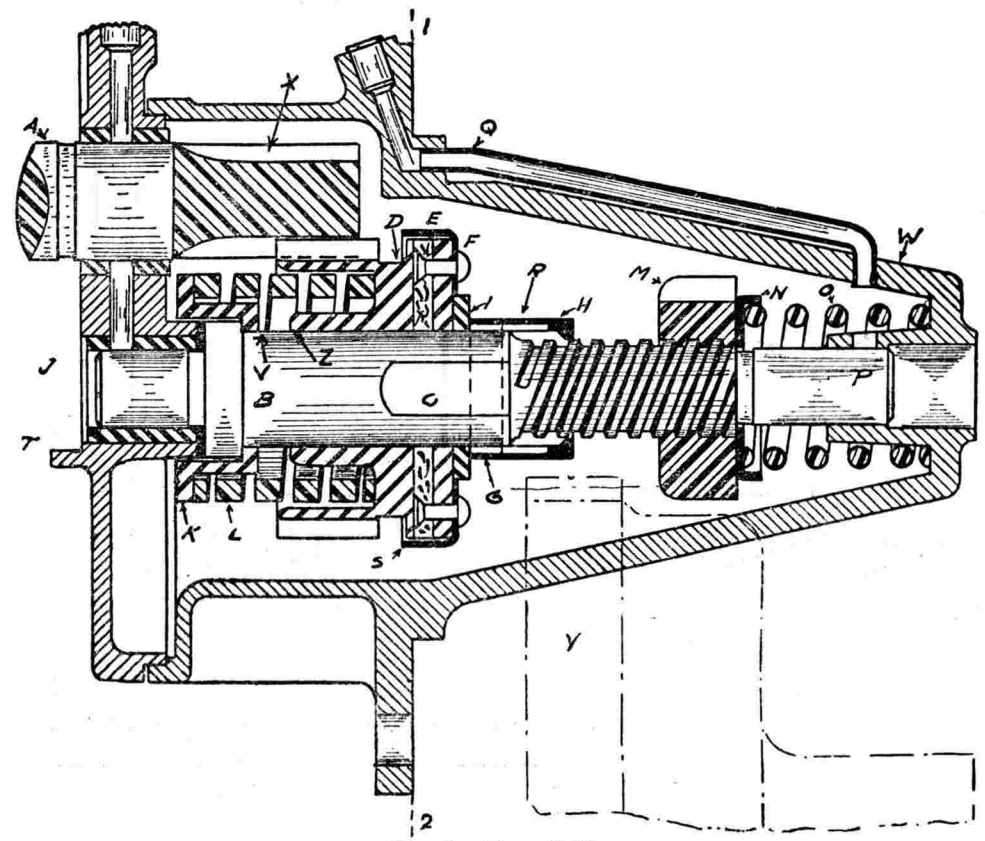


Direct Acting Type

POSITIVE GEARED TYPE

OPERATION.—The teeth in the motor armature shaft (X) are permanently meshed with the gear (D), which drives the shaft (B) through the clutch assembly (E, F, I, G, H.). When shaft (B) turns, the pinion (M) screws itself to the left, meshing with the flywheel gear (Y). The pinion comes in contact with the sleeve (H) and forces the clutch assembly and drive gear (D) to the left, compressing spring (L). As spring becomes compressed, the pressure exerted between the face of the drive gear (D) and the clutch member (E) is sufficient to transmit to the drive shaft the power necessary for cranking the engine. When the engine begins to run under its own power, the pinion (M) is driven faster by the flywheel than the shaft (B) is driven by the starter, hence the pinion screws itself to the right, out of mesh with the flywheel gear. The demeshing movement of the pinion is cushioned by the spring (O). Should the pinion fail to mesh with the flywheel gear due to the ends of the teeth striking, the pinion will cease to turn. The shaft (B) and assembly then screws itself to the right until the sleeve (H) comes into contact with the pinion, causing the pinion to turn. When the pinion then meshes with the flywheel gear, the spring (O) causes the shaft (B) and assembly to return to normal position.

ADJUSTMENT AND CARE.—The drive shaft (B) must be free to slide 5/8 inch endwise. The driven clutch plate (F) must be free to slide on the shaft (B). To determine the initial torque of the clutch, due to the tension of the spring (L), clamp the shaft (B) firmly in a vise, and fasten a brake having a lever arm one foot long to the gear (D). Attach a spring balance to the free end of the lever arm and determine the pull necessary to cause the clutch to slip. This pull must not be less than 4 pounds or more than 12 pounds. The spring (L) has has a free length of 2 1/8 to 2 1/4 inches. If the clutch slips, due to surface of gear (D) becoming polished, the gear should be put in a lathe and a fine cut taken off its face to roughen it. If pinion (M) sticks on the shaft, clean both pinion and shaft thoroughly with gasoline.



Positive Geared Type

AMERICAN BOSCH MAGNETO

TYPE ZR-4 AND ZR-6 FOUR AND SIX CYLINDER MODELS

DESCRIPTION:—The Bosch Magneto Type ZR is of the high tension armature type. Two magnets are mounted above the armature and the end plates completely enclose all working parts. A safety spark gap is located above the armature under the magnets. The Type ZR magneto can be used with a Bosch Duplex Vibrating ignition coil to provide dual battery and magneto ignition. The Type ZR-4 magneto should be driven at crankshaft speed on four cylinder four cycle engines. The Type ZR-6 magneto must be driven at one and one half crankshaft speed on six cylinder four cycle engines. The direction in which magneto should be driven is stamped on the frame.

OILING:—Put 2 or 3 drops of light machine oil in the oiler at each end of the magneto every 500 miles of operation. Do not oil the interrupter. Examine interrupter occasionally and wipe off all oil and dirt.

BREAKER:—Breaker or interrupter contacts separate .4 millimeter or 1/64 inch with interrupter arm on highest point of cam. At this point the fiber bumper of the interrupter arm will be in the center of the steel segment of the cam ring. Set contact gap by turning armature shaft until fiber bumper is on highest point of cam. Then loosen lock nut on stationary contact stud and turn contact until proper gap is secured. Tighten the lock nut. Contacts are made of platinum. Resurface contacts with worn No. 00 sandpaper or with a fine flat jeweler's file. Do not use emery cloth.

TIMING:—Crank engine until crankshaft reaches proper position for piston in No. 1 cylinder with manual advance lever fully retarded. See manufacturers' specifications as given on specific car data sheets in Reed Service Manual. Fully retard magneto advance arm and turn magneto in direction of rotation until contacts begin to separate when the fiber bumper of the interrupter arm reaches the steel segment in the cam ring. Make certain that magneto is firmly bolted to base mounting and couple drive shaft to engine without disturbing either crankshaft or magneto armature shaft. Remove distributor cover and note position of distributor brush. Connect the segment directly over the brush to the spark plug in cylinder No. 1 and connect remaining plugs in proper firing order around the distributor plate in a direction opposite to rotation of the interrupter.

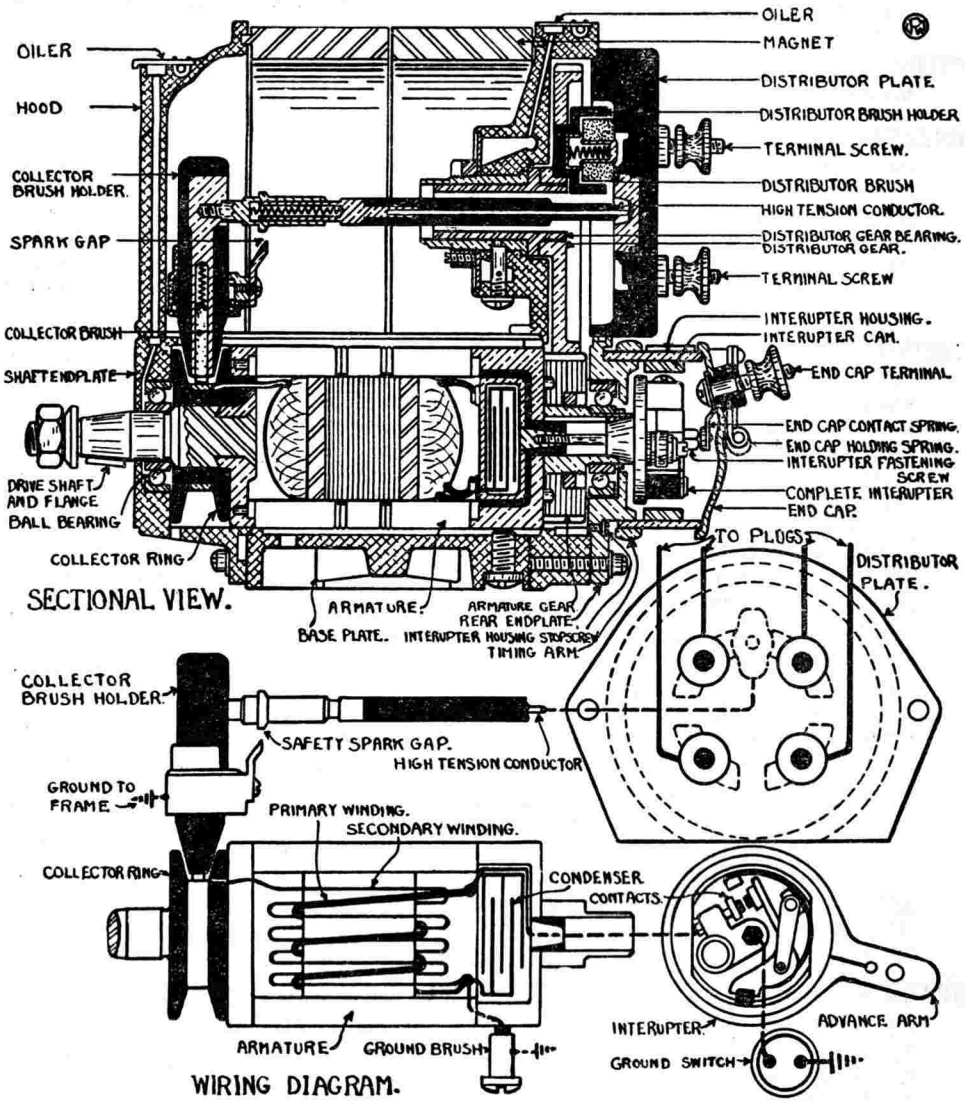
When manufacturers' specifications are not available, the engine may be timed to fire with piston on top dead center entering power stroke with full retard. Crank engine over until piston No. 1 enters compression stroke (the upstroke with both valves closed). Then continue to crank engine slowly noting dead center on flywheel or checking piston travel with a wire inserted in spark plug port until the piston reaches top dead center. Then connect magneto as directed above.

Timing Magneto with Impulse Coupling:—Turn magneto in direction of rotation until coupling is released from arrester plate. This point will be after proper firing position since impulse coupling will spin magneto over firing position. Then turn magneto backward in direction opposite to rotation until the breaker contacts open and begin to close as fiber bumper passes off steel segment in cam ring. This is the correct firing position and the magneto can then be coupled to the engine.

SPARK PLUG GAPS:—Spark plug gaps must be set at .020 or 1/50 inch. It is important that the gap be set at this figure. If spark plug gap is too wide engine will miss at low speeds and will be difficult to start. A safety spark gap is located above the armature. If spark jumps safety gap frequently check magneto and spark plugs to locate trouble.

TROUBLE SHOOTING:—Engine Misses on One Cylinder:—Check spark plugs for correct gap. Check spark plug in missing cylinder for short circuit due to fouling or cracked insulator. Check for chafed or burnt insulation on cable. Check distributor plate for dirty distributor track or segment.

Irregular Firing on All Cylinders:—Check interrupter contacts and set gap. Resurface contacts if necessary. Tighten fastening screw in center of interrupter plate. Check ground brush under armature in base plate. Check collector brush and collector ring. Check distributor plate and wipe out with a clean rag moistened with gasoline if dirty or gummed with oil.



AMERICAN BOSCH MAGNETO - TYPE ZR.

AMERICAN BOSCH MAGNETO

TYPES AT-4 AND AT-6 FOUR AND SIX CYLINDER MODELS

DESCRIPTION:—Bosch Magneto, Type AT, is of the high tension armature type. A single magnet is mounted over the armature and end plates completely enclose all working parts. Magneto can be equipped with Type IC-200 automatic impulse coupling or Type EC impulse coupling which is entirely enclosed in a water and dust-proof housing. Type G automatic advance governor can also be fitted to Type AT magneto. The Type AT-4 should be driven at crankshaft speed on four cylinder, four cycle engines and the Type AT-6 should be driven at one and one half times engine speed on six cylinder four cycles engines. Magneto must be driven in direction indicated on frame.

OILING:—Put one or two drops of light machine oil in the oiler at each end of the magneto every 500 miles. Do not oil interrupter.

BREAKER:—Breaker contacts separate .4 millimeter or 1/64 inch with interrupter arm on highest point of cam. Breaker contacts and mounting are fixed on end of armature shaft and rotate while cam and cam ring are stationary. To set contact gap, turn armature shaft until fiber bumper is on highest point of cam. Then loosen lock nut on stationary contact stud and turn contact until proper gap is secured. Tighten the lock nut. Contacts are made of platinum. Resurface contacts with worn No. 00 sandpaper or with a fine flat jeweler's file. Do not use emery cloth.

TIMING:—Crank engine until crankshaft reaches proper position for piston in No. 1 cylinder with manual advance lever fully retarded. See manufacturers' specifications as given on specific car data sheets in Reed Service Manual. Fully retard magneto advance arm and turn magneto in direction of rotation until contacts begin to separate when the fiber bumper of the interrupter arm reaches the steel segment in the cam ring. Make certain that magneto is firmly bolted to base mounting and couple drive shaft to engine without disturbing either crankshaft or magneto armature shaft. Remove distributor cover and note position of distributor brush. Connect the segment directly over the brush to the spark plug in cylinder No. 1 and connect remaining plugs in proper firing order around the distributor plate in a direction opposite to rotation of the interrupter.

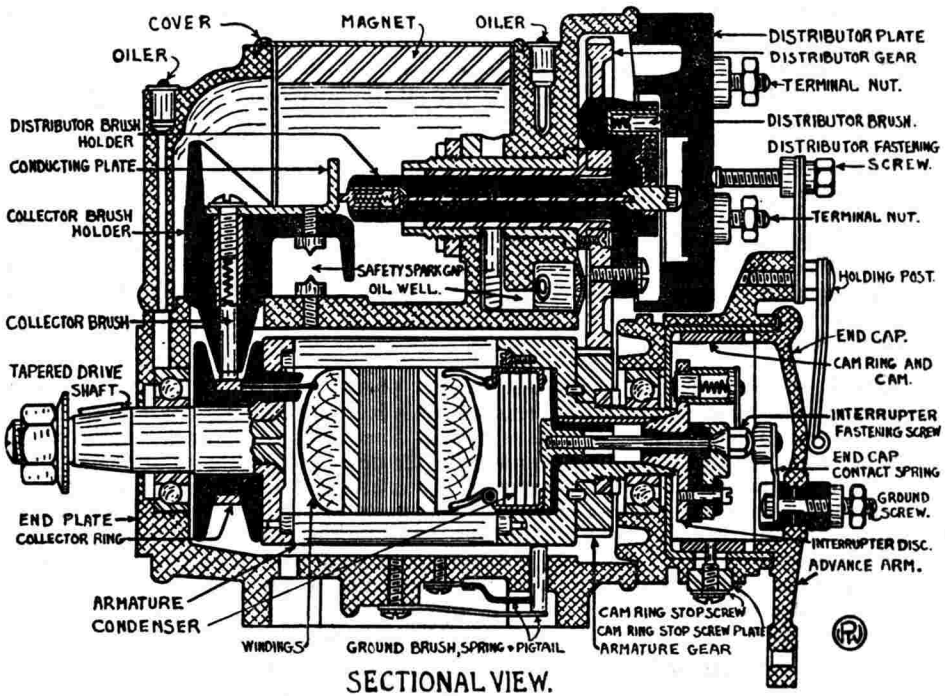
When manufacturers' specifications are not available, the engine may be timed to fire with piston on top dead center entering power stroke with full retard. Crank engine over until piston No. 1 enters compression stroke (the upstroke with both valves closed). Then continue to crank engine slowly noting dead center on flywheel or checking piston travel with a wire inserted in spark plug port until the piston reaches top dead center. Then connect magneto as directed above.

Timing Magneto with Impulse Coupling:—Turn magneto in direction of rotation until coupling is released from arrester plate. This point will be after proper firing position since impulse coupling will spin magneto over firing position. Then turn magneto backward in direction opposite to rotation until the breaker contacts open and begin to close as fiber bumper passes off steel segment in cam ring. This is the correct firing position and the magneto can then be coupled to the engine.

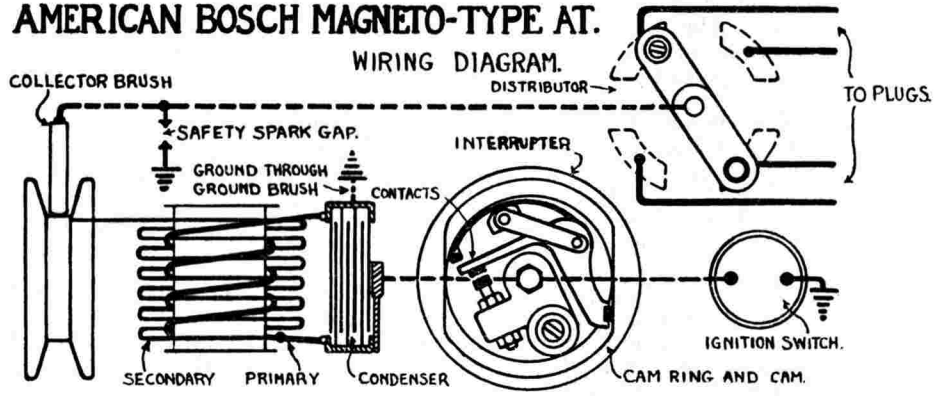
SPARK PLUG GAPS:—Spark plug gaps must be set at .020 or 1/50 inch. It is important that the gap be set at this figure. If spark plug gap is too wide engine will miss at low speeds and will be difficult to start. A safety spark gap is located above the armature. If spark jumps safety gap frequently check magneto and spark plugs to locate trouble.

TROUBLE SHOOTING:—Engine Misses on One Cylinder:—Check spark plugs for correct gap. Check spark plug in missing cylinder for short circuit due to fouling or cracked insulator. Check for chafed or burnt insulation on cable. Check distributor plate for dirty distributor track or segment.

Irregular Firing on All Cylinders:—Check interrupter contacts and set gap. Resurface contacts if necessary. Tighten fastening screw in center of interrupter plate. Check ground brush under armature in base plate. Check collector brush and collector ring. Check distributor plate and wipe out with a clean rag moistened with gasoline if dirty or gummed with oil.



SECTIONAL VIEW.



ROBERT BOSCH MAGNETO

TYPES FF4A AND FF6A. FOUR AND SIX CYLINDER MODELS

DESCRIPTION:—The Robert Bosch Magneto Types FF4A and FF6A are of the armature type with all moving parts entirely enclosed. They are furnished with cylindrical base for cradle mounting or with flat base with locating pins for bracket mounting. Magneto should be driven only in direction shown by arrow on collector ring brush holder.

ADVANCE:—Type FF4A has 40° manual advance range. This is equal to 40° measured on flywheel since magneto must be driven at crankshaft speed. Type FF6A has 60° manual advance range equal to 40° on the flywheel since the magneto must be driven at 1½ times crankshaft speed. An automatic advance device may be fitted to all FF4A and FF6A magnetos giving an automatic advance range of 30°. This may be used in conjunction with the manual advance or the manual advance mechanism may be locked by inserting a set screw screwed in the endplate so that it fills the notch in the interrupter housing. The interrupter must first be turned to the fully advanced position. The manual advance arm may be set in any desired position to facilitate connecting of advance control rod. The advance arm ring is held in position by friction against the interrupter housing. To set arm, loosen set screw in side of arm and turn to desired position. Then tighten the set screw.

BREAKER:—Breaker is mounted on end of armature shaft and rotates with armature. Contacts separate 1/64 inch with bumper of contact arm on cam. Clean contacts with a soft brush and gasoline. Contacts may be trued up with a fine flat contact file or on a medium hard oilstone. To replace contacts, remove hexagonal headed screw and remove breaker. Replace in correct position.

OILING:—The armature shaft is mounted on ball bearings packed with heavy grease. The breaker arm pivot pin is oiled by wick oiler saturated with oil. This is sufficient for a running period of 35,000-50,000 miles and need be renewed only when the magneto is disassembled for servicing. Every 4500 miles remove the oil plug in the top of the magneto at rear of distributor housing and fill oil hole with heavy machine oil. It may be necessary to warm the oil but it is essential to use heavy oil so that it will not get in the distributor or breaker housing.

TIMING:—To check magneto for correct position of armature when contacts open. Remove the distributor plate. There are two circular windows in the large gear marked 'R' and 'L'. Fully advance manual control arm and turn magneto shaft in direction of rotation until red line on stationary pole piece is visible through proper window. Use 'R' window in timing clockwise magnetos and 'L' window in timing counter-clockwise drive magnetos. Slowly turn the shaft until the red mark on the end of the armature lines up with the red mark on the pole piece. If magneto is correctly assembled the breaker contacts will just begin to separate at this point.

To time magneto to engine. Crank engine until crankshaft reaches proper firing position of No. 1 cylinder with manual advance lever fully retarded. See manufacturer's specifications as given on specific car data sheets in the National Manual. Then fully retard manual advance arm and turn magneto shaft in direction of rotation until red line on pole piece appears through proper window in distributor gear. Continue to turn the shaft until breaker contacts begin to separate. Couple the magneto to the engine being careful not to disturb the relative position of the magneto and crankshaft. Connect the segment opposite the carbon brush in the distributor head to the spark plug in cylinder No. 1. Connect the remaining terminals to the spark plugs following the proper firing order of the engine.

IMPULSE COUPLING:—Both the FF4A and FF6A magnetos can be fitted with impulse couplings to furnish a very hot spark at low speeds to start the engine. To time engines where impulse couplings are used, it will be necessary to turn the magneto in the opposite direction from that in which the magneto is driven (as given by arrow on collector brush holder). If this is not done the impulse coupling will spin the armature over the timing position so rapidly that it will be impossible to set magneto.

SPARK INTENSIFIER:—A spark intensifier or auxiliary spark gap can be fitted to the magneto. This is provided with a switch on the dash and inserts a second spark gap in the secondary circuit when the plugs are fouled. To install spark intensifier it is necessary to remove collector brush holder and install special unit with two terminals for cables to the switch. If it is desired to operate magneto equipped for spark intensifier without this device, it will be necessary to connect a short piece of high tension cable between the two terminals on the side of the collector brush holder.

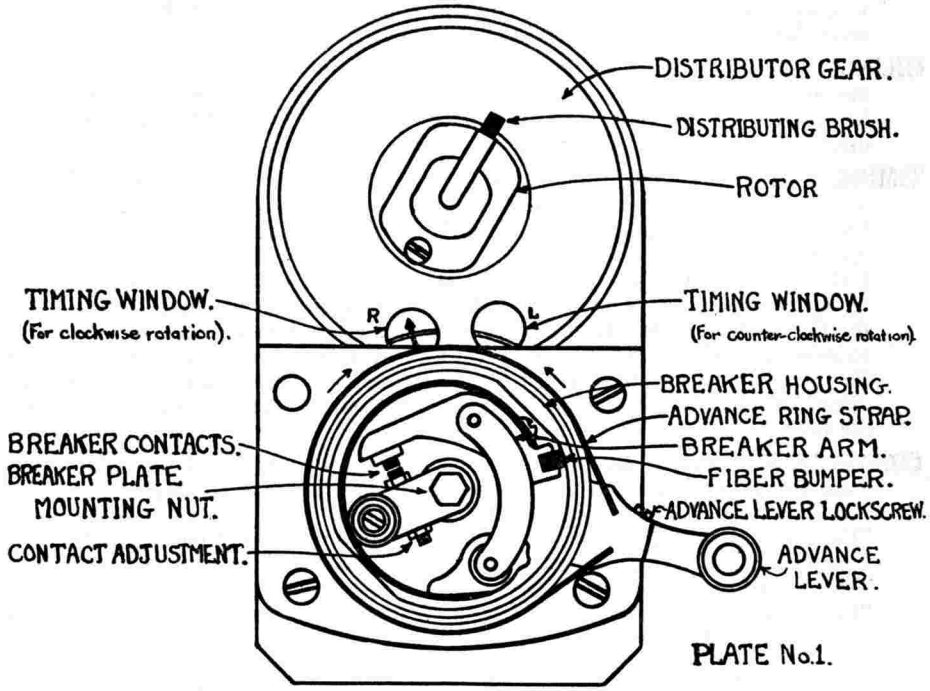


PLATE No.1.

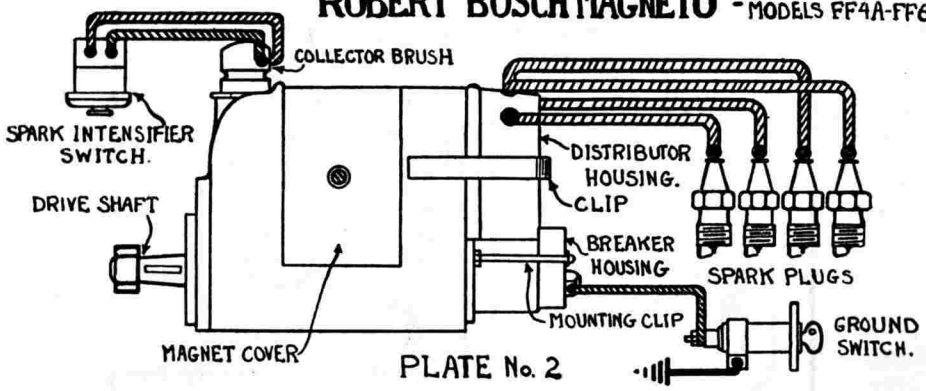


PLATE No. 2

BOSCH

TWO INDEPENDENT IGNITION SYSTEM

OPERATION.—By the use of this system the engine may be operated on either the magneto, battery, or both magneto and battery. Two sets of spark plugs must be used. Any independent single spark magneto may be used. The battery system consists of a breaker, distributor, and combined coil and switch. The battery system is entirely independent of the magneto.

CONSTRUCTION.—The construction, dimensions, and internal electrical connections of the coil are depicted in Figure 1, Plate 181. Construction of the breaker and distributor mechanism is shown in Figure 2. The breaker unit is driven at cam-shaft speed, and is fastened to the driving member by means of the sleeve "1" and the taper pin "2".

BREAKER.—The battery breaker contacts separate .018 to .020 inch. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 3 or 4 drops of light engine oil in the bearings of the breaker unit every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles. Oil the magneto as directed on page dealing with type used.

TIMING.—Time the magneto to the engine as directed on the page dealing with the type magneto used. It is essential that both systems operate simultaneously, that is, both breakers must open at the same instant. To time the battery system to the magneto, proceed as follows: Turn the engine slowly by hand until the magneto breaker contacts are just beginning to separate, with the grounding switch closed in order that no spark will occur. Loosen the battery breaker unit on its driving shaft. Remove the distributor cap and turn the sleeve until the breaker contacts are just beginning to separate. Then make the sleeve fast to the driving member in this position, replace the distributor cap, and connect the high tension cables to the plugs in the proper firing order, making sure that both systems produce sparks in the same cylinder at the same instant.

CONNECTIONS.—Proper connections are shown in Figure 3. Essential connections made by the switch in the four positions of the handle are as follows:
"Off" position—"2" connected to "6". "5" open.
"Batt" position.—"2" connected to "6". Primary winding of coil connected between "5" and "1". Secondary winding of coil connected between "4" and "6".
"Mag" position.—"2" open. "5" open.
"Batt" and "Mag" position.—"2" open. Primary winding of coil connected betweer "5" and "1". Secondary winding of coil connected between "4" and "6".

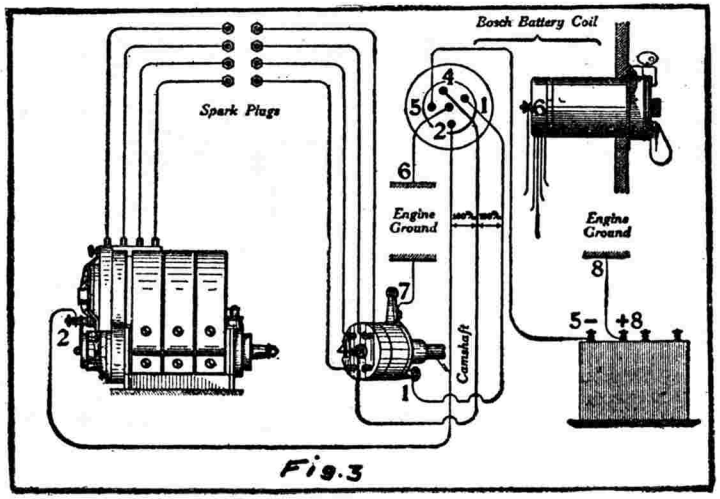
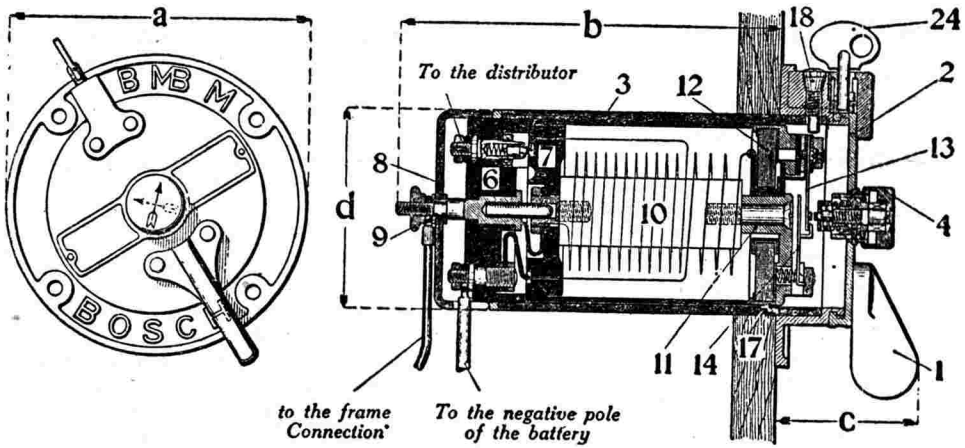


Fig. 3

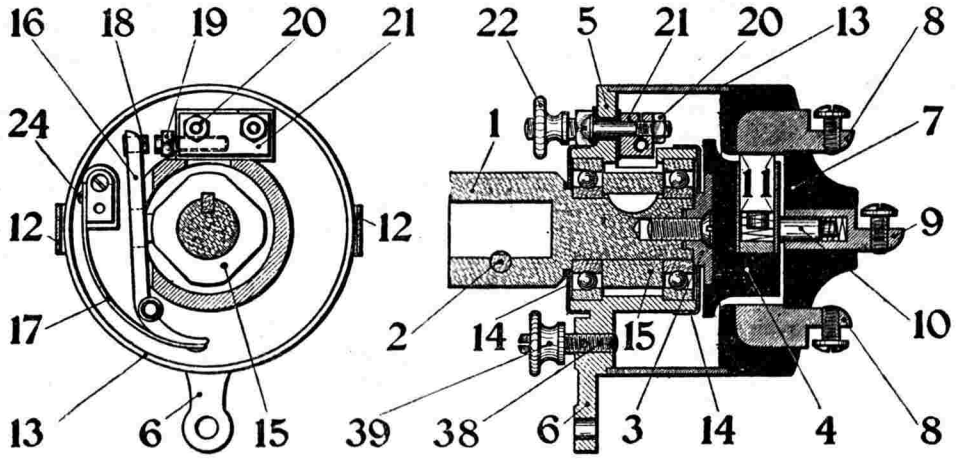
Dimensions { *a = 105 mm, b = 135 ", c = 50 ", d = 71 "*

Horizontal Coil Type "C".



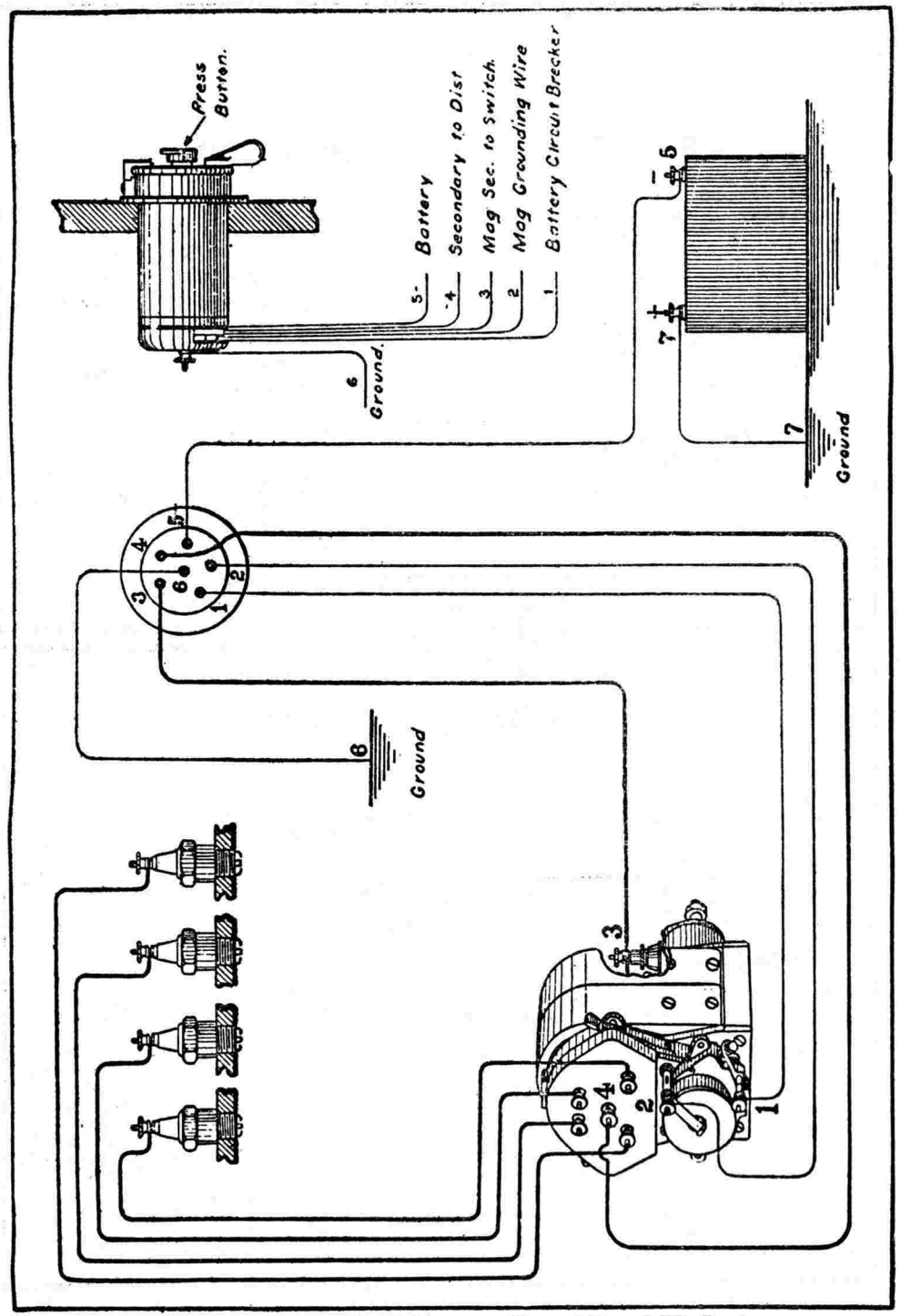
1. *Switch handle.*
2. *Movable cover.*
3. *Coil housing.*
4. *Starting press button.*
6. *Fixed connection plate.*
7. *Movable switch plate.*
8. *Cable cover.*
9. *Milled edged nut.*
10. *Iron core.*
11. *Plate carrying the starting arrangement and the condenser.*
12. *Condenser.*
13. *Contact spring.*
14. *Vibrator.*
15. } *Auxiliary contact breaker.*
16. }
17. *Vibrator spring.*
18. *Stop screw for switch handle.*
24. *Locking key.*

Fig. 1.



1. *Sleeve shaft*
2. *Key*
3. *Catch plate.*
4. *Rotating distributor piece.*
5. *Base plate*
6. *Timing arm.*
7. *Distributor disk.*
8. *Binding post for spark plug cable.*
9. *Binding post for current conducting cable.*
10. *Fixed carbon brush.*
11. *Rotating carbon brush.*
12. *Flat fastening spring.*
13. *Distributor housing.*
14. *Protecting cap.*
15. *Steel cam.*
16. *Contact breaker lever.*
17. *Contact breaker spring*
18. *Short platinum rivet.*
19. *Long platinum screw*
20. *Lock nut for screw 19.*
21. *Insulated contact piece.*
22. *Binding nut for primary winding.*
38. *Threaded bolt.*
39. *Nut for threaded bolt.*

Fig. 2



Bosch Magneto, Types DU and ZR, Dual

BOSCH MAGNETO

TYPES DU AND ZR, DUAL

ROTATION.—The direction in which the magneto must be driven is indicated by an arrow at the drive end.

BREAKER CONTACTS.—Breaker contacts separate .014 to .016 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 2 or 3 drops of light engine oil in each of the magneto oilers every two weeks. Apply a small amount of vaseline to the fiber bumper of the contact arm with a toothpick. If car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the spark is desired to occur. Place the breaker housing in the fully retarded position, by turning it as far as it will go in the direction of armature rotation. Remove the breaker cap and turn the armature shaft until the breaker contacts are just beginning to separate. Then couple the magneto to the engine, being careful not to change the relative position between the armature shaft and driving member. Remove the distributor block and note which segment is in contact with the distributor brush. Replace block and connect the terminal of this segment with the plug in No. 1 cylinder. Connect the other cables in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .020 to .030 inch, depending upon the characteristics of the engine.

DUAL COIL.—Connections made by the switch in the three positions of the handle are as follows:

"Off" position—"2" connected to "6". "5" open.

"Batt" position—"2" connected to "6". Primary winding of coil connected between "5" and "1". Secondary winding of coil connected between "4" and "6".

"Mag" position—"2" open. "5" open. "3" connected to "4".

For the purpose of starting on the spark, where no starting motor is provided, a magnetic vibrator may be cut into the coil circuit by turning the button in the center of the coil face, to the right. The coil is provided with with a key and lock, by means of which the switch may be locked in the "Off" position.

BOSCH MAGNETO

TYPES D, DR AND ZR, TWO-SPARK, INDEPENDENT AND DUAL

OPERATION.—The purpose of a two-spark ignition system is to produce ignition at two points in the combustion chamber, thus cutting down the time interval between ignition and complete combustion, which in turn adds power and efficiency to the engine. Bosch two-spark magnetos are produced in either independent or dual types. In external appearance the two-spark magneto is very similar to the single-spark type, the chief difference being the distributor and the fact that there is an extra safety gap. On the single-spark type of magneto one end of the secondary is grounded, while on the two-spark type both ends are brought out to two segments diametrically opposite on a single slip-ring. Two slip ring brushes are provided, which are horizontally located on opposite sides of the magneto end plate. During the portions of the armature rotation when the secondary is delivering current, each of the brushes will be in contact with a slip ring segment. One brush is connected to the inner distributor as in a single-spark magneto, while the other brush is connected to the outer distributor by means of a short cable passing around the magnets. The distributor rotor is of double length and carries two brushes, insulated from each other.

BREAKER.—Breaker contacts separate .015 inch. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper

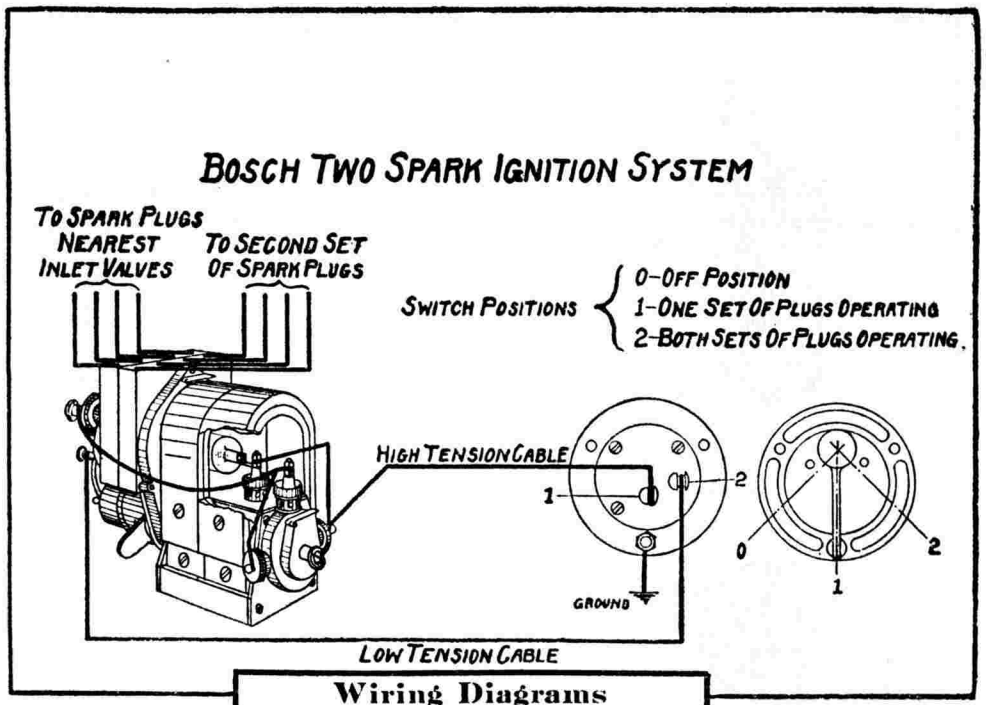
OILING.—Put 2 or 3 drops of light engine oil in each of the oil cups every two weeks. Put a small amount of vaseline on the cam, applying with a toothpick. If the car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Turn the magneto shaft until the breaker contacts are just beginning to separate, with the breaker housing in the fully retarded position. Couple the magneto to the engine. The use of two-spark ignition does not require the same amount of advance as the single-spark type, due to the much shorter time which elapses between ignition and complete combustion. The effect of retarding the spark results if one set of plugs is cut out of operation.

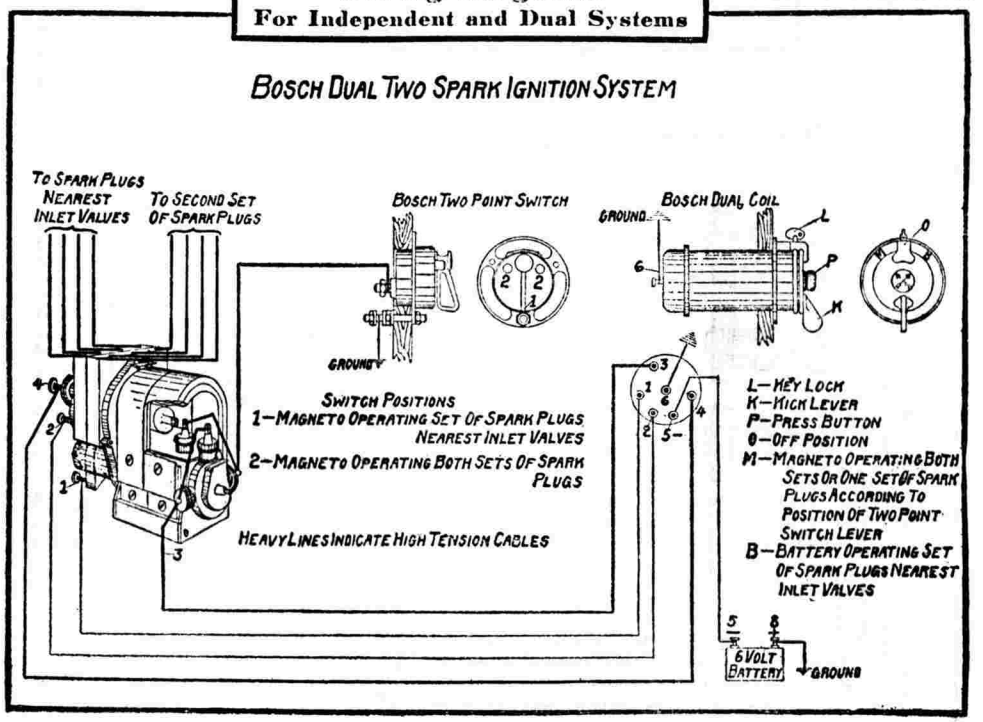
SPARK PLUG GAPS.—Spark plug gaps are .016 to .030 inch, depending upon the characteristics of the engine.

SPARK PLUG LOCATION.—No advantage is secured from the use of two-spark magnetos if the spark plugs are located close together. They must be separated by at least one-half of the width of the combustion chamber, inclusive of valve-pockets. In "T" head engines it is customary to place the plugs in the inlet and exhaust valve caps.

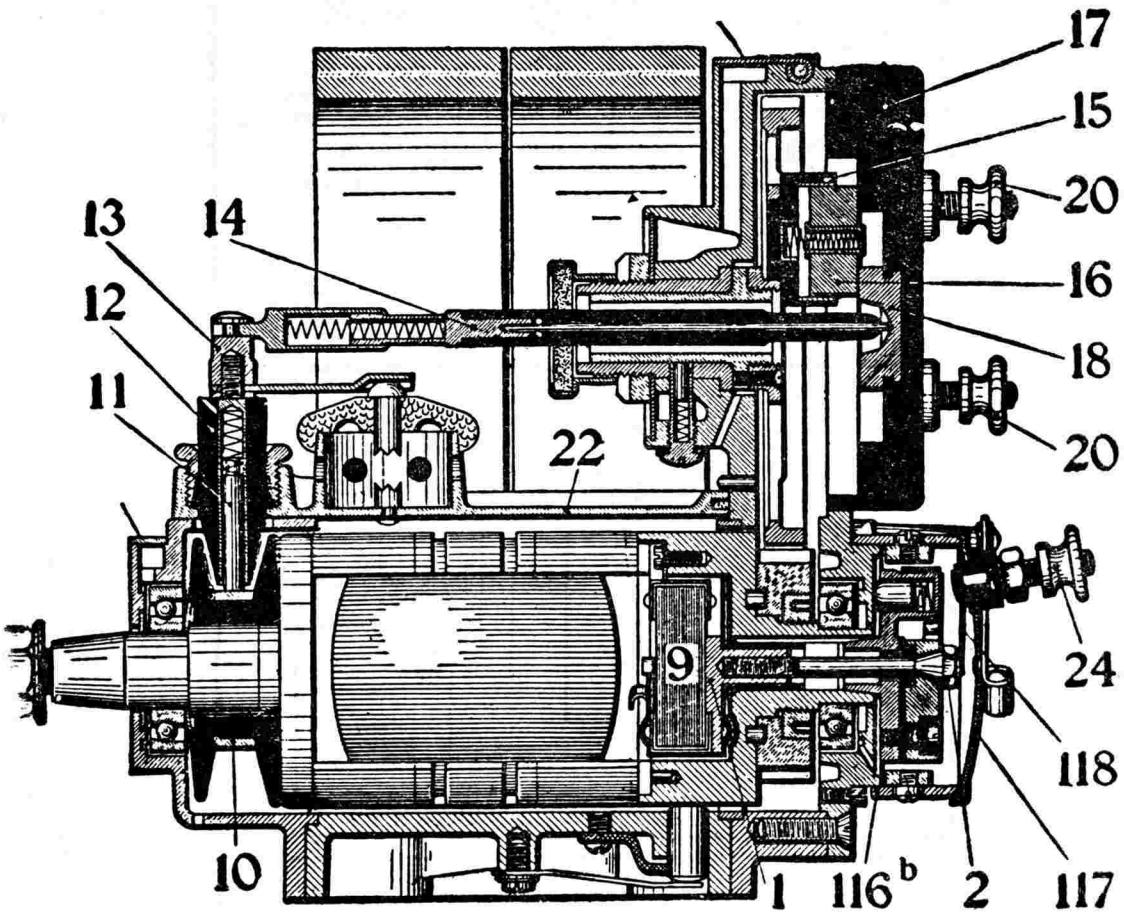
DUAL COIL.—The coil is the same as is used with the single-spark dual system. In both the independent and dual systems a switch is arranged to cut one set of plugs out of operation by grounding one end of the secondary winding of the magneto.



Wiring Diagrams
For Independent and Dual Systems



Longitudinal Section of DU4 Magneto



1. Brass plate for connecting the end of armature primary circuit.
2. Fastening screw for magneto interrupter.
9. Condenser.
10. Slipring.
11. Slipring brush.
12. Slipring brush holder.
13. Cap nut for slipring brush holder.
14. Connecting bar.
15. Distributor brush holder.
16. Distributor brush.
17. Distributor plate.
18. Central distributor contact.
20. Terminal nut for distributor plate.
22. Dust cover over armature.
24. Terminal nut for grounding terminal.
116. Interrupter housing and timing arm.
117. Cover for interrupter housing.
118. Contact spring for grounding terminal.

BOSCH MAGNETO

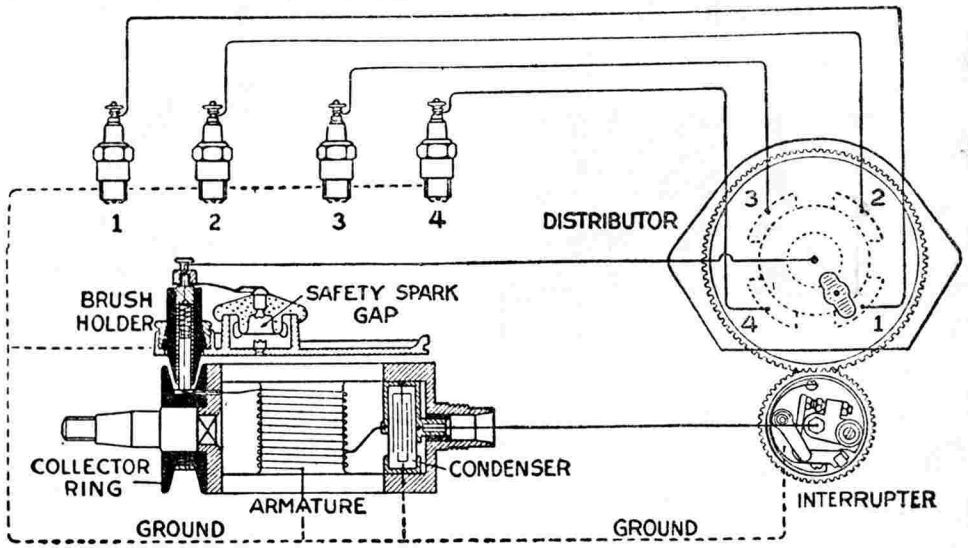
TYPES DU4 AND DU6, SINGLE SPARK, INDEPENDENT

BREAKER CONTACTS.—Breaker contacts separate .014 to .016 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 2 or 3 drops of light engine oil in each of the magneto oilers every two weeks. Apply a small amount of vaseline to the fiber bumper of the contact arm with a toothpick. If the car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the spark is desired to occur. Place the breaker housing in the fully retarded position by turning it as far as it will go in the direction of the armature rotation. Remove the breaker cap and turn the armature shaft until the breaker contacts are just beginning to separate. Then couple the magneto to the engine, being careful not to change the relative position between the armature shaft and driving member. Remove the distributor block and note which segment is in contact with the distributor brush. Replace block and connect the terminal of this segment with the plug in No. 1 cylinder. Connect the other cables in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .020 to .025 inch.



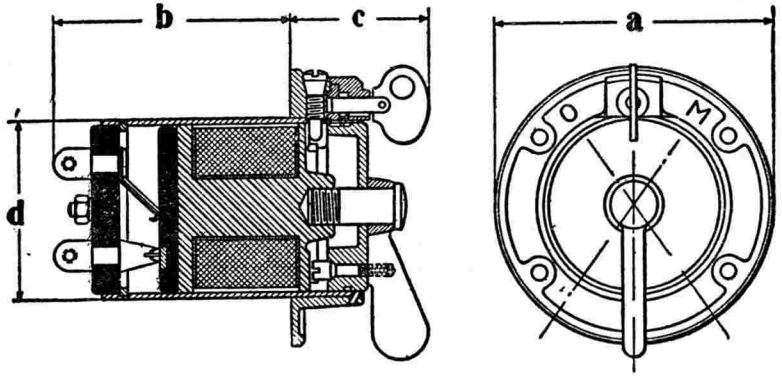
Bosch Magneto, Circuit Diagram, Type DU4

BOSCH

DUPLEX IGNITION SYSTEM

OPERATION.—This system is intended to produce easy starting. The battery side is not intended to be used as a separate ignition system, as is the case in dual systems, but to aid the magneto in producing a hot spark at low speeds. When the switch is in the "Battery" position (center), the single winding in the coil is in series with the battery and the breaker contacts of the magneto. The primary winding of the magneto is shunted around the breaker contacts in the usual manner. In order that the battery may aid the magneto, the current from the battery must flow through the magneto winding in the same direction in which the current produced in the winding is flowing. Since the magneto current reverses as the shuttle revolves, a commutating device is provided in order that the current from the battery will reverse also, and at the same time. This commutator consists of two metal segments on the inside of the breaker box cover and two carbon brushes which revolve with the breaker, making contact with the segments. The switch should be placed in the "M" position when the engine is running. Except for the commutator described above, the magneto is the same as the corresponding type of independent magneto, and the instructions given for them also apply when equipped for duplex ignition.

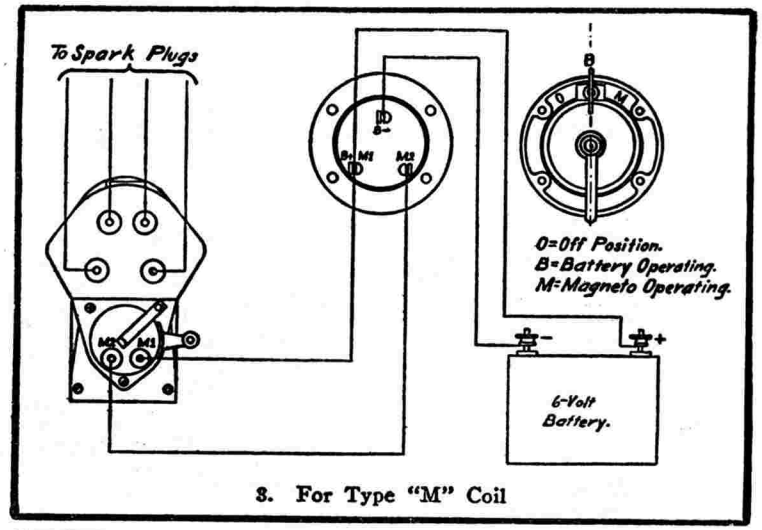
COMBINED COIL AND SWITCH.—Type M. The connections made in the switch in the three positions of the handle are as follows:
"Off" position.—"B+M1" connected to "M2". "B—" open.
"Batt" position—"B+M1" open. Coil connected between "B—" and "M2".
"Mag" position.—No connections within switch.
The other coils are the same, except that the battery is entirely disconnected from the magneto in the "Off" and "Mag" positions. The coil may be removed from its case by removing the screw in the flange, when the switch handle is in the position "B".



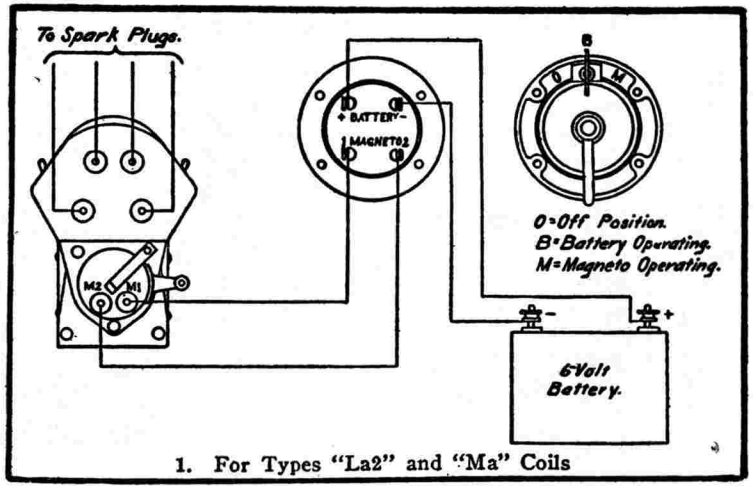
a	b	c	d
90	73	45	58.5

Dimensions are in millimeters.
Calculate 25.4 mm to the inch.

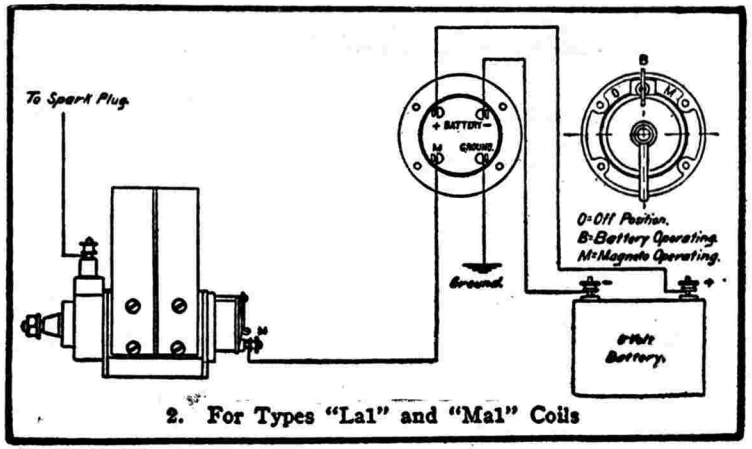
Dimensions of Bosch Duplex Coils



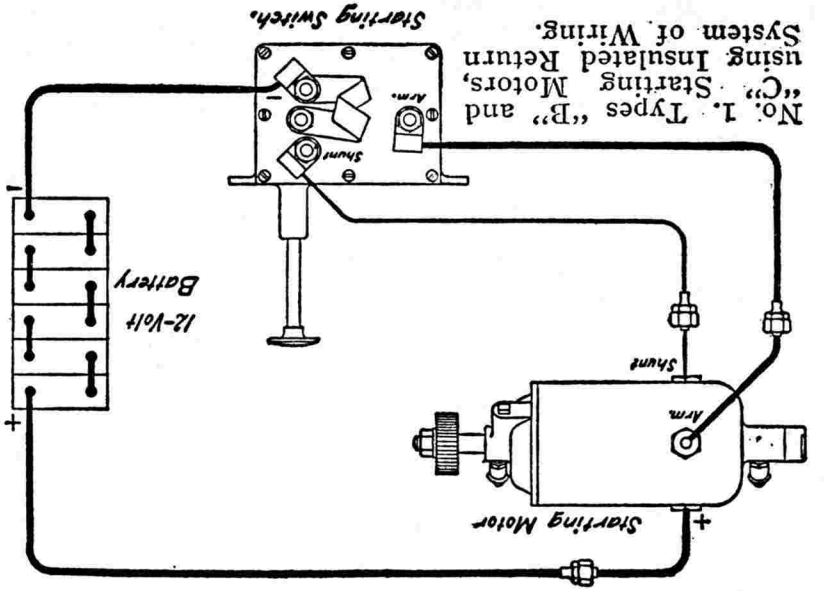
3. For Type "M" Coil

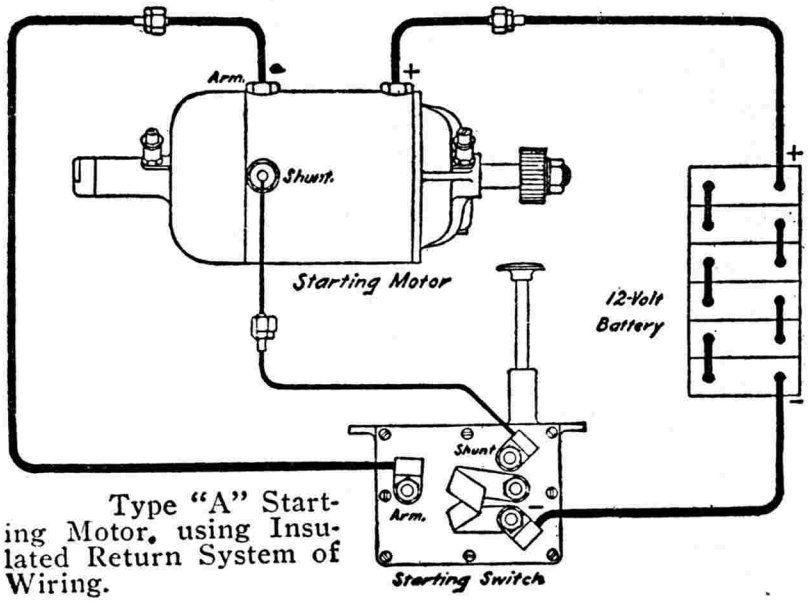


1. For Types "La2" and "Ma" Coils

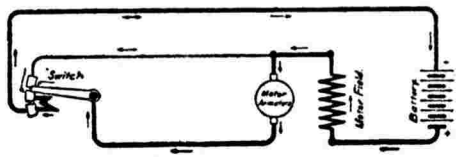


2. For Types "La1" and "Ma1" Coils





Type "A" Starting Motor, using Insulated Return System of Wiring.



Electrical circuit during first part of downward movement of switch pedal.

Bosch, or Rushmore, Starter

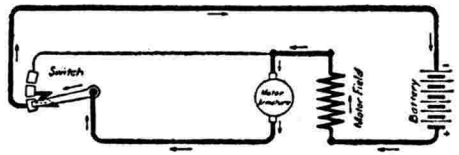
The Bosch, or Rushmore, starter as it is sometimes called, is made in nine sizes, as given below, with the size battery and cables used with each:

Motor Type	Voltage	Ampere Capacity	Main Cable Gauge	Shunt Cable Gauge
A8,813	6	160	00	4
A8,913	12	80 to 100	00	4
B2, B5	6	120 to 150	00	4
C3	6	100 to 120	0	6
B2, B5	12	80	0	4
C3	12	50 to 60	1	6
C18	12	50 to 60	3	6
C41	12	35 to 50	2	6
C42	6	80 to 100	1	6

When very long cables are used, as is sometimes the case in motor boats, the size next largest to that tabulated should be used for the main cable, the shunt cable remaining the same size as tabulated.

When the starting pedal is depressed, the moving contact in the starting switch is moved along three stationary contacts in the switch. The armature is so constructed as to have considerable end play. There is a spring at the commutator end, which holds the armature in position so that the pinion is clear of the flywheel gear when current is off. When connection is made between the movable contact and the first, or shunt, and the second contact in the switch, a large current is allowed to flow through the shunt field. This acts as a powerful electro-magnet and draws the armature into the working position in the motor. As the pinion is fastened to the end of the motor shaft, it is drawn into mesh with the flywhel gear. A small current also flows through the resistance and the armature, causing the latter to turn slowly. This is to facilitate meshing of the gears. When connection is made between the moving contact and the last stationary contact in the switch, the full battery pressure is applied to the motor, turning it with full power, cranking the engine. As the engine begins to run on its own power and the speed of the motor inrceases, the attraction between the armature and the field poles decreases, due to the decreased current caused by the greater back pressure, and the demeshing of the gears results. No harm can come of keeping the starting switch closed after gears are demeshed, as the motor will be running at full speed, thus not consuming enough current for the attraction between the field poles and the armature to overcome the spring pressure. When the foot is removed from the starting pedal, the switch is returned to its normal position by a spring. The foot should always be removed entirely from the pedal so as not to hinder the quick action of the spring. Should the starting pedal be depressed so rapidly that the gears do not have time to mesh, the motor will rotate freely. In this case the pedal must be released and the motor allowed to come to rest before switch is closed again.

Each end of the motor is provided with an oiler feeding oil to the bearing and shaft by means of a wick. If starter is used only normally, three or four drops of oil should be put in each of the oilers every 1000 miles. If starter is used frequently, four or five drops of oil must be put in each oiler every 500 or 600 miles. In cases where starter is on a marine engine, it should be oiled every three weeks. Use good, clean, light machine oil.



Electrical circuit established when switch pedal has completed its downward movement.

Bosch Lighting Systems

Types DSR and DSG Generators

Battery.—Battery is 6 volt, 100 ampere-hour, or 12 volt, 50 ampere-hour. The two wire system is used or the positive (+) terminal is grounded.

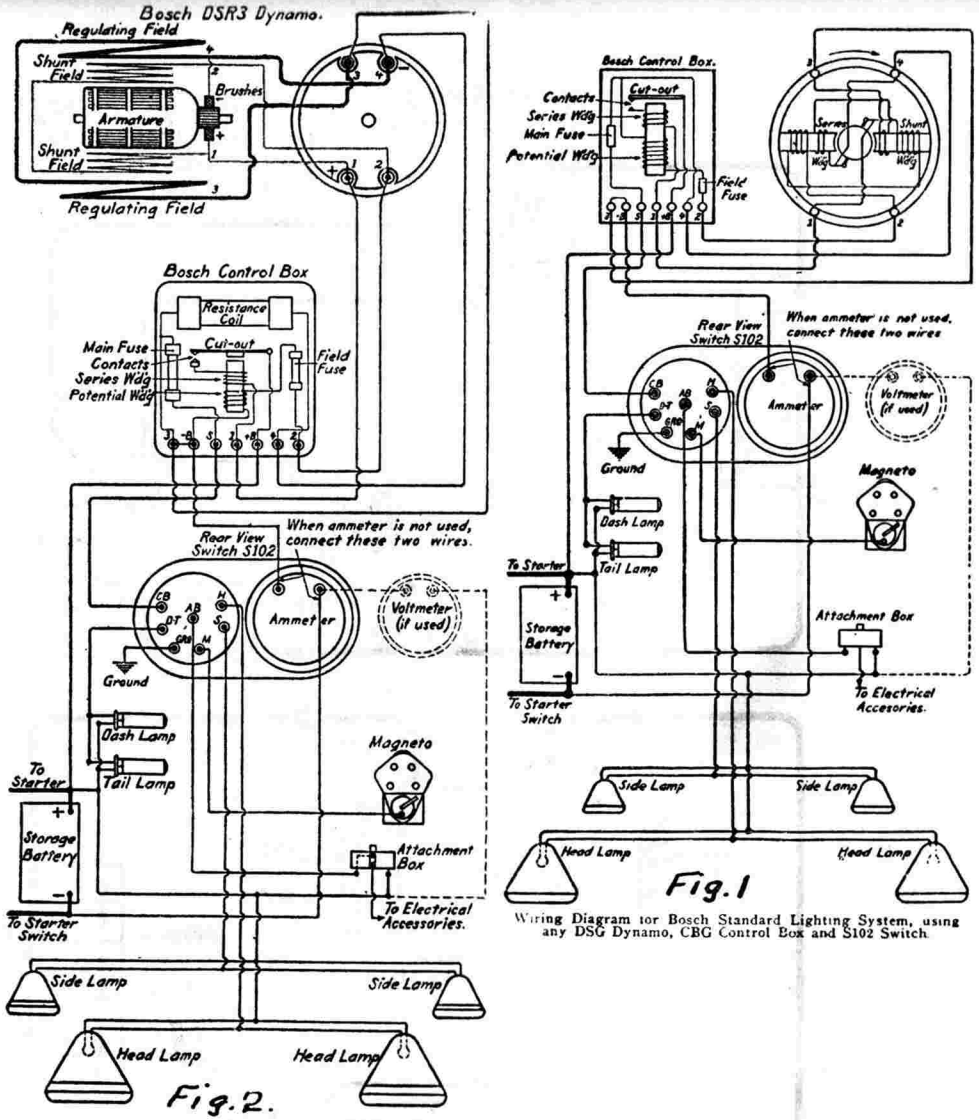
Generator.—Type DSR. Current regulation is by reverse series field, operating in conjunction with a regulating resistance. This regulating resistance is connected in shunt with the reverse series field. When cold this unit has a very small resistance, but when hot it has a greatly increased resistance. When cold it forms practically a short circuit across the series field terminals, allowing but little current to flow through the series field. As the current through the resistance increases, the temperature and resistance increases, causing more current to flow through the reverse winding, reducing the output. As the resistance of the regulating coil increases in proportion to the current through it, the output is held practically constant at speeds above that necessary to produce the maximum output. The current output may be varied by changing the size of the regulating resistance. Maximum current output is 9 amperes.

Generator.—Type DSG. Types DSG5, 6, 7, 8, 107 and 108 have reverse series field current regulation. Types DSG105 and 106 are also compound wound, but the series winding conducts current to the lamps only, and assists the shunt field by strengthening the magnetism. To facilitate wiring, the generator terminals are numbered 1, 2, 3 and 4. These terminals are connected to the relay terminals bearing corresponding numbers. The outputs of the various types are as follows:

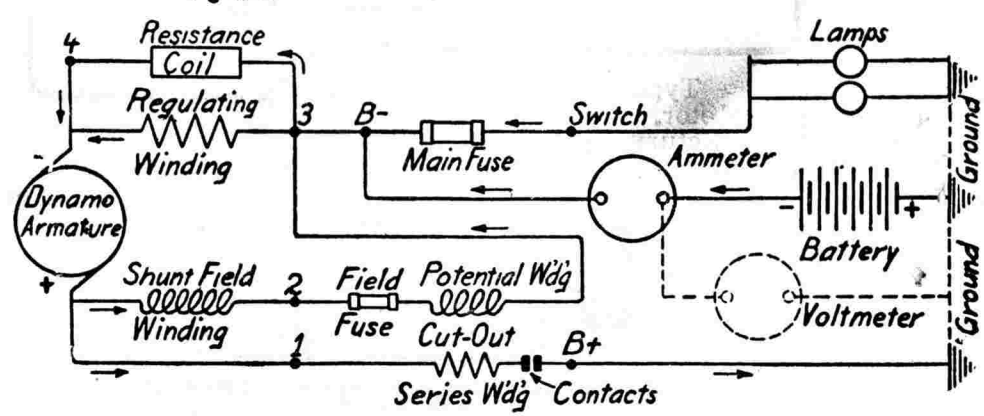
Generator Type	Voltage	Maximum Ampere Output
DSG5	12	7
DSG6	6	14
DSG7	12	9
DSG8	6	18
DSG105	12	5
DSG106	6	10
DSG107	12	6
DSG108	6	12

Oiling.—Put 2 or 3 drops of light engine oil in each of generator bearing oilers every two weeks. If car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

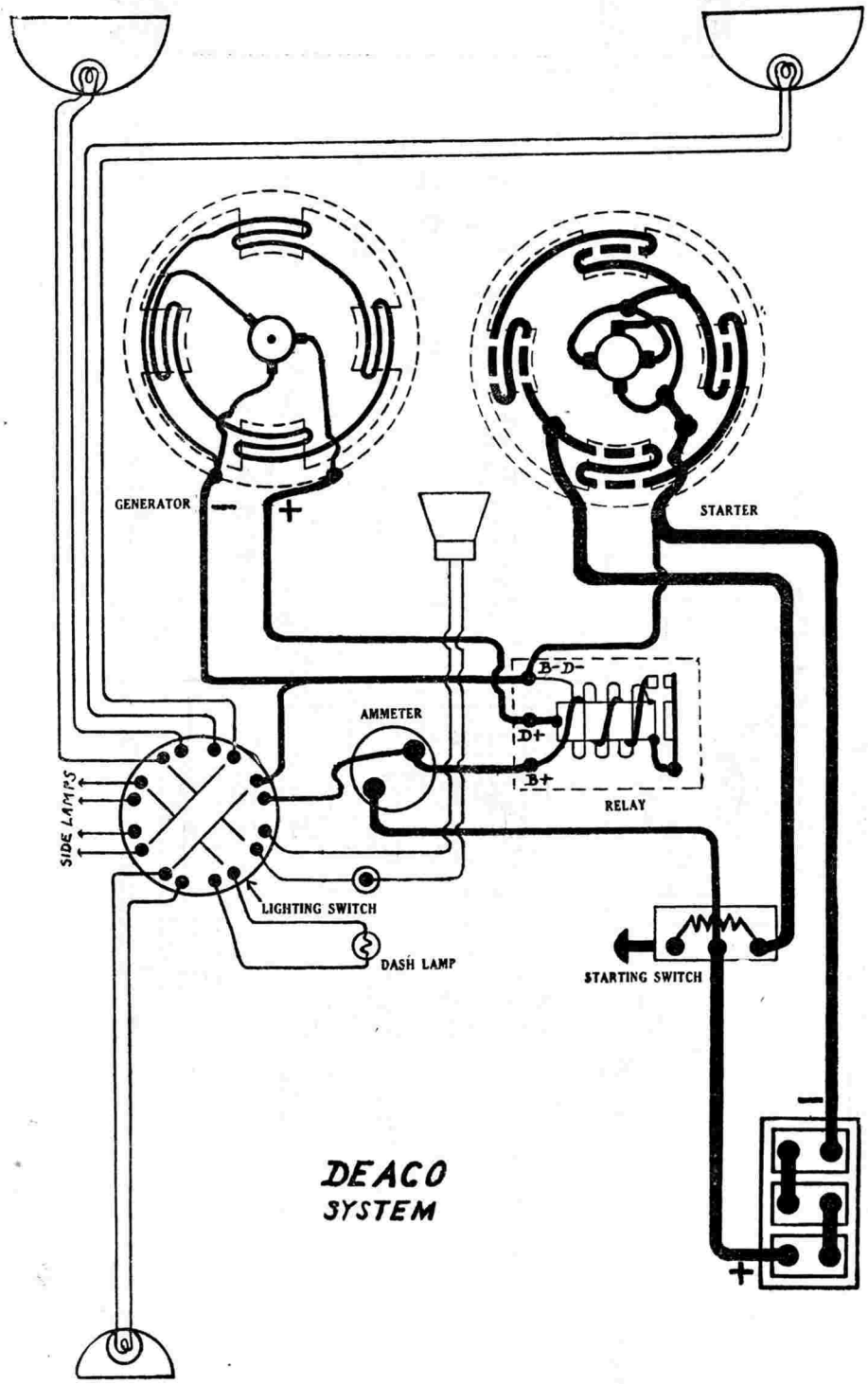
Relay.—Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sand paper. Remove all grit. Adjust before again putting into service.



Wiring Diagram for Bosch Standard Lighting System, using any DSG Dynamo, CBG Control Box and S102 Switch.



Complete Circuit Diagram of Bosch Standard Lighting System, using DSR3 Dynamo and Ground Return System of Wiring.



DEACO

GENERATING AND STARTING SYSTEM

BATTERY.—Battery is 6 volt, 85-100 ampere-hour. The negative (—) terminal is grounded.

STARTER.—Starter is connected to the engine through a pinion shifted by the operator. The same mechanical movement also operates the starting switch. Starting switch first closes the circuit through a resistance, which causes the motor armature to revolve slowly to aid the meshing of the gears and then cuts out the resistance, allowing the full current to flow for cranking.

OILING.—Put 5 or 6 drops of light engine oil in the starter oilers every month.

GENERATOR.—Generator current regulation is by the third brush method. Maximum current output is 15 amperes for the engine-speed generator and 12 amperes for the 1½ times engine-speed generator. Maximum current output is reached at 20 miles per hour. Charging rate is varied by adjustment of the third brush setting. To move the third brush first loosen the two locking screws which pass through a slot in the commutator end plate. Move the brush in the direction of armature rotation to increase the charging rate and in the opposite direction to decrease the charging rate. Reseat the brush after adjusting position.

OILING.—Put 4 or 5 drops of light engine oil in each of the generator bearing oilers every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

RELAY.—Relay is usually mounted on the dash. Relay closes at 8-10 and opens at 6-8 miles per hour. Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

LARGE 1914 SINGLE COIL GENERATING, STARTING AND LIGHTING SYSTEM

This system is used on the following cars:

1914 Buick, Model B55	**1914 Oakland, Model 43**
1914 Cole, Series 9	**1914 Oakland Model 6-48**
1915 Cole, Series 10	**1914 Oakland, Model 6-60**
1914 Moon, Model 42	**1914 Oldsmobile, Model 54**
1914 Moon, Model 6-50	**1915 Oldsmobile, Model 55**

BATTERY.—Battery is 6 volt, 80-120 ampere-hour. The negative (—) terminal is grounded.

STARTER.—Starter and generator are combined into one unit, but are electrically separate. Starter is connected to engine through a set of reduction gears meshed by the operator. Pressing the "Start" button brings ignition relay into action and connects terminals 8 and 9 on the combination ignition and lighting switch, completing circuit around relay. This applies battery pressure to generator windings, causing armature to revolve slowly, aiding meshing of the gears. Depressing the starting pedal then meshes the gears, opens the generator circuit and completes motor circuit, causing it to crank the engine. Two overrunning clutches are provided. Clutch at driving end permits rotation of armature necessary during cranking operation. The second overrunning clutch prevents engine driving starter through the reduction gears.

GENERATOR.—Generator voltage regulation is by mercury tube type regulator. Generator is shunt wound, in which type of machine the voltage, hence ampere output increases rapidly as speed increases, unless controlled by some means. The voltage erator is shunt wound, in which type of machine the voltage, hence ampere output, reducing its strength and controlling voltage. The regulator (See Plate 65A-3) consists of a tube made of German silver, lined with insulating varnish. Inside the large tube is a smaller bakelite tube. Both tubes contain a pool of mercury at the bottom. Mercury is to make a flexible connection between the moving and stationary elements of the regulator. The resistance coil and the contact rod (D), dip into the mercury pools. The height of the coil, hence the amount of the wire above the mercury, is regulated by the electro magnet, A. The plunger G is surrounded and actuated by the Coil A. This coil is connected across the generator terminals. The greater the current througho it, the higher the plunger C and resistance coil will be lifted. Raising the coil adds additional resistance to the shunt field, thus reducing the voltage of the generator. The regulator is so proportioned that the voltage is held practically constant after the desired maximum is reached.

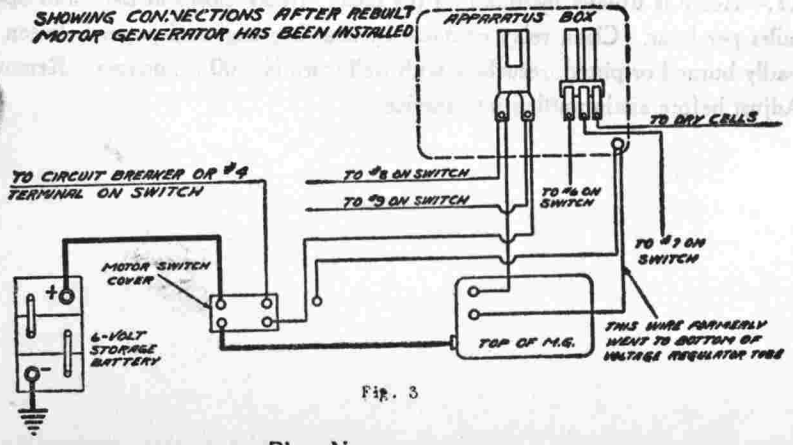


Fig. 3

Plate No.

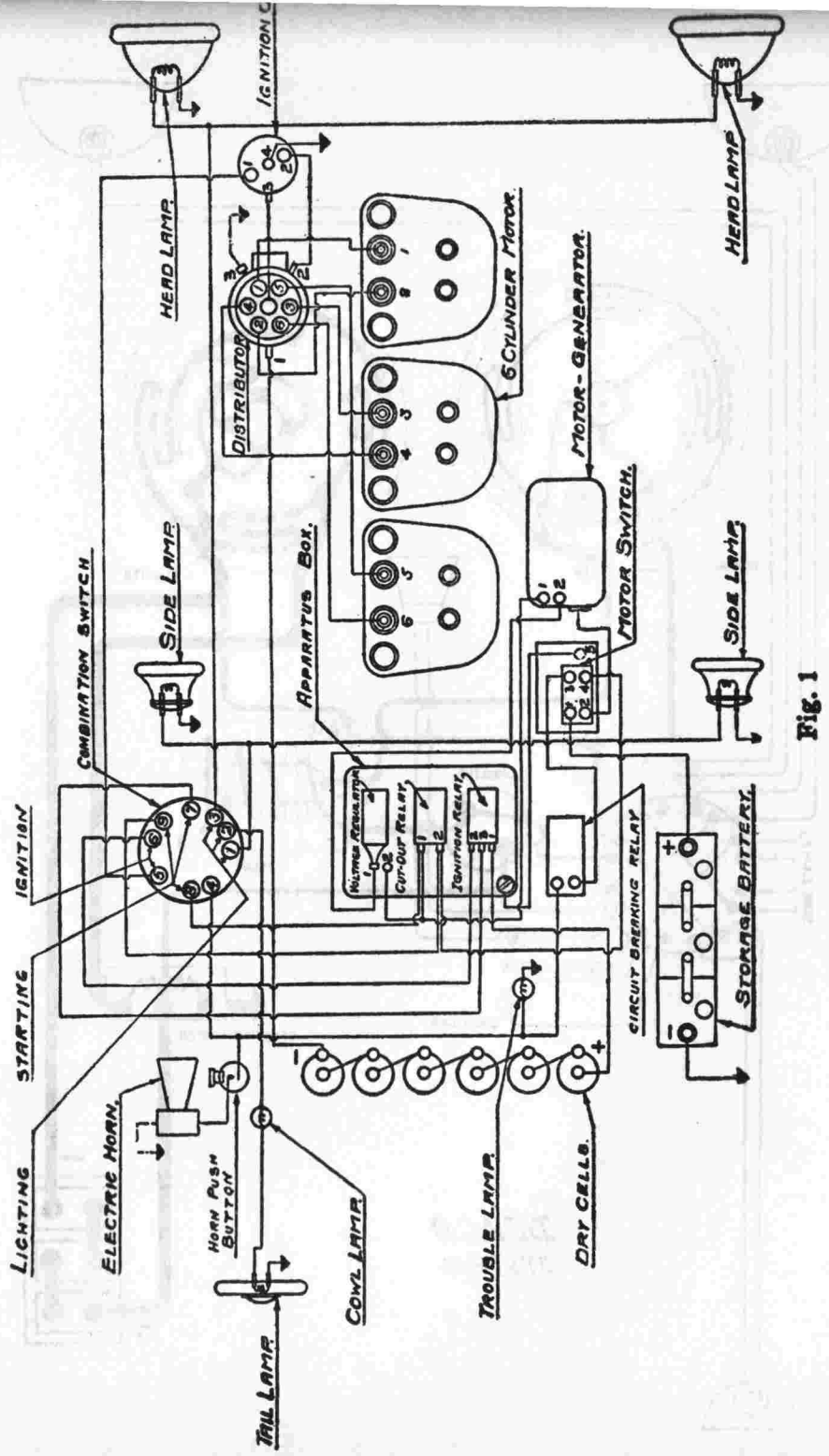


Fig. 1

Delco, Large 1914 Single Coil System

DELCO

LARGE 1914 SINGLE COIL GENERATING, STARTING AND LIGHTING SYSTEM

Continued from preceding page.

TROUBLE SHOOTING.—If generator is operated at high speeds with excessive resistance in charging circuit, the work the regulator is made to do may be too great for it. In this case, voltage will rise to excessive values, sometimes burning out regulator coil, resistance, relay or generator field. Should generator fail to produce an electrical pressure, test regulator for open circuit by temporarily bridging across the fiber gasket at bottom, with a piece of metal. If generator then acts properly, mercury tube is at fault. To test shunt field for open circuit, press the "Start" button on lighting ignition switch. If armature attempts to revolve in a counter-clockwise direction, viewed from front end, shunt field circuit is open. There is a temperature regulator at bottom of mercury tube. Turn the regulator in a clockwise direction when viewed from the top, to increase the voltage.

OILING.—Put 4 or 5 drops of light engine oil in each of starter-generator bearing oilers every two weeks. If car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles. Refill grease cup at end of idler gear shaft with soft cup grease and turn down every month.

RELAY.—Relay closes at 7-10 miles per hour or 350-450 R.P.M. of armature, and opens at 5-7 miles per hour, or 300-350 R.P.M. of armature. Charging current is 1-3 amperes at closing and the discharge current is 0-2 amperes at opening of relay. Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

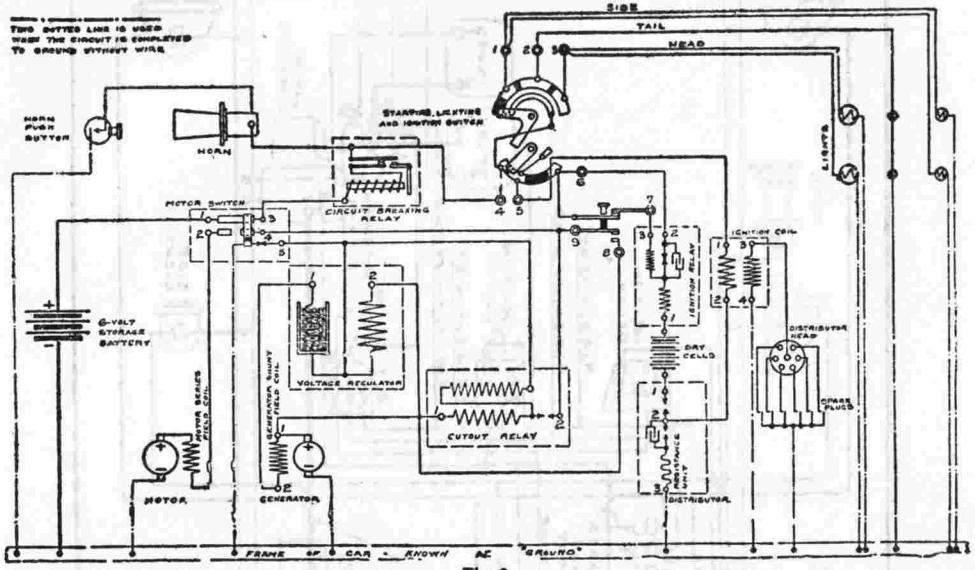
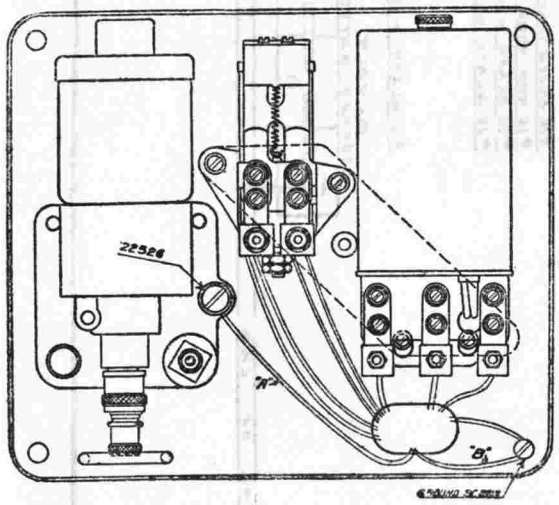
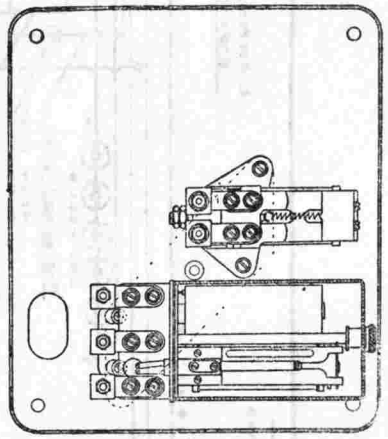
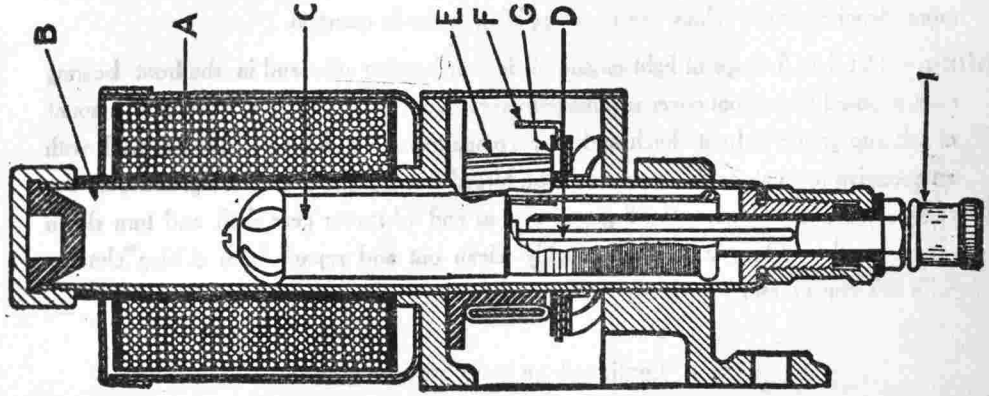


Fig. 2







Delco

Small 1914 Single-Coil Generating, Starting and Lighting System

This system is used on the following cars:

1914 Buick, Models B-24-25, B-36-37
1914 Carter Car, Model 7
1914 Hudson, Model 6-40
1914 Keeton, Model 4-35
1914 Oakland, Model 36
1914 Oldsmobile, Model 42
1914 Paterson, Models 32-33
1914 Westcott, Model O-A

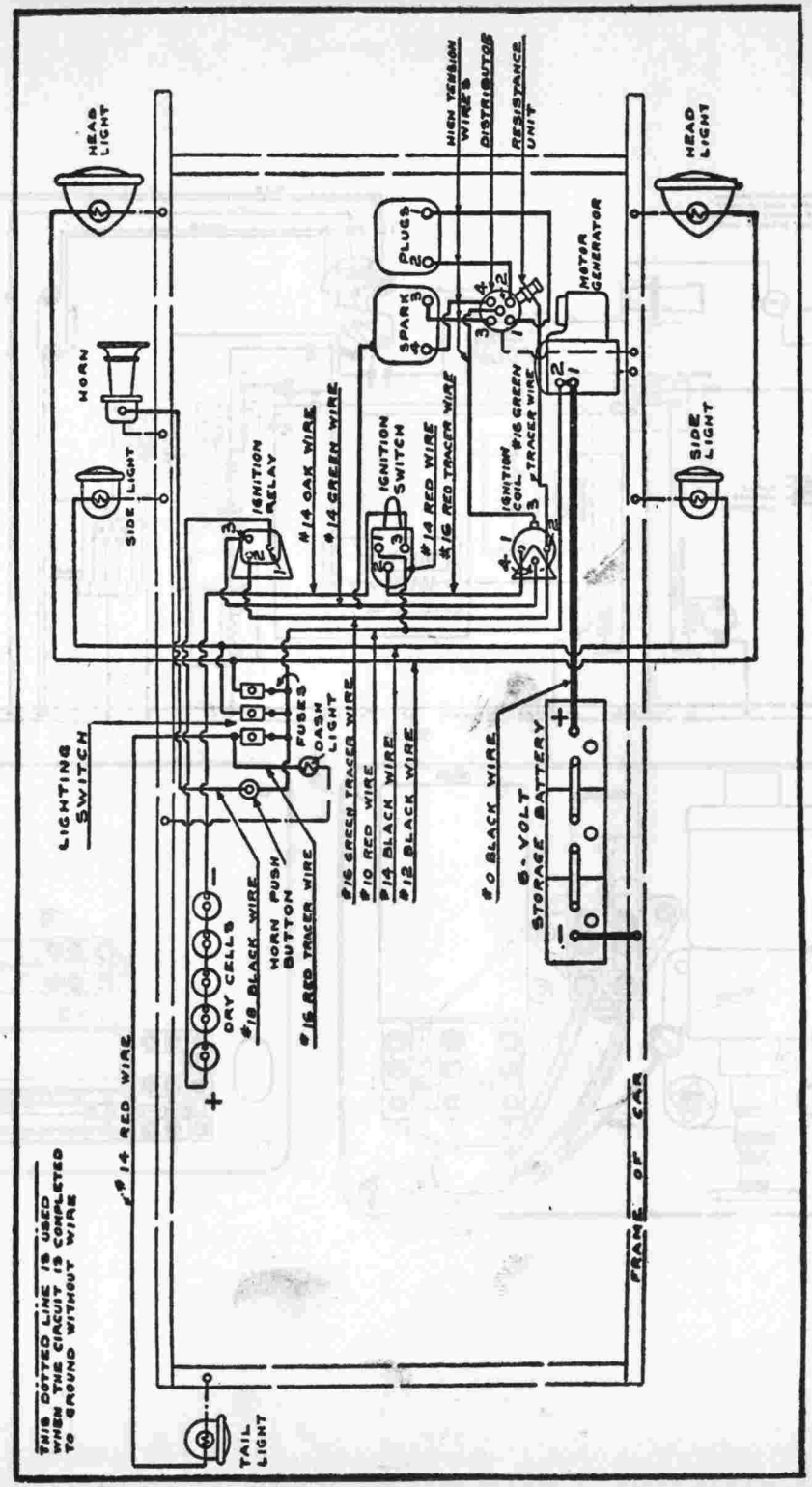
Battery.—Battery is 6 volt, 80-120 ampere-hour. The negative (—) terminal is grounded

Starter.—Starter and generator are combined into one unit, but are electrically separate. Starter is connected to engine through a set of reduction gears meshed by the operator. Two overrunning clutches are provided. Raising and lowering of one motor brush serves as a starting switch. A catch on the brush lifting-rod mechanically closes the cutout relay, allowing current to flow through generator windings, causing armature to revolve slowly, aiding meshing of gears. After gears are meshed, one generator brush is raised and motor brush is allowed to cpme in contact with commutator, completing the starter circuit and cranking the engine. When the pedal is released,a spring reverses above operations. One clutch permits motoring of generator and also the relatively high speed of armature necessary when operating as a starter. The other clutch prevents engine driving armature through the reduction gears.

Generator.—Generator current regulation is by reverse series field. Maximum current may be anywhere between 14 and 20 amperes, depending on the make of the car. For more definite current values, see page applying to car in question.

Oiling.—Put 4 or 5 drops of light engine oil in rear bearing oiler and in the front bearing oiler, exposed when front cover is removed, every two weeks. Keep a reasonable amount of soft cup grease in front clutch and gear compartment, at all times. Do not pack with an excessive amount, as this causes it to be forced through the front bearing, and onto the commutator and brushes. Refill grease cup at end of starter gear shaft and turn down every month. Once a year thoroughly clean out and repack both driving clutches with soft cup grease.

Continued on next page.



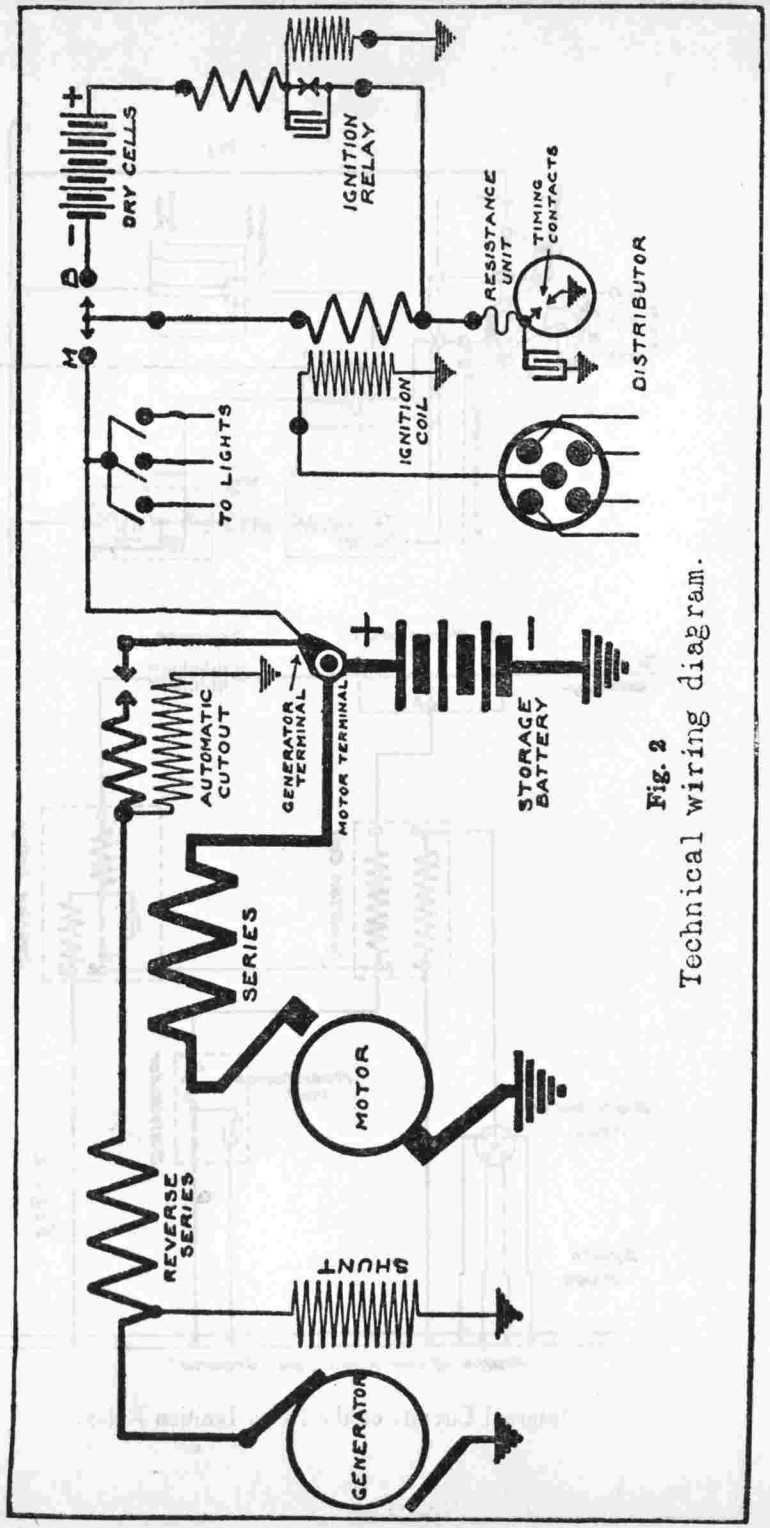


Fig. 2 Technical wiring diagram.

Delco

SMALL 1914 SINGLE COIL GENERATING, STARTING AND LIGHTING SYSTEM

Continued from preceding page.

RELAY.—Relay closes at 7-7½ volts. Charging current is 1 to 3 amperes at closing and the discharge current 0-1 ampere at opening of relay. Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

CONNECTING AMMETERS.—To install an ammeter in this system, it will be necessary to cut or remove the strap connecting terminals 1 and 2 (see below). On some machines this strap is outside, as shown at A, and on others on the inside, as shown at B. On machines having strap on the outside, strap may be cut with a hacksaw and ammeter installed without removing machine from car. If strap is on the inside, it is necessary to remove and disassemble machine to remove the strap. After strap is removed, a wire is run from No. 2 terminal to positive (+) side of ammeter, and from the No. 1 terminal to the negative (—) terminal of ammeter.

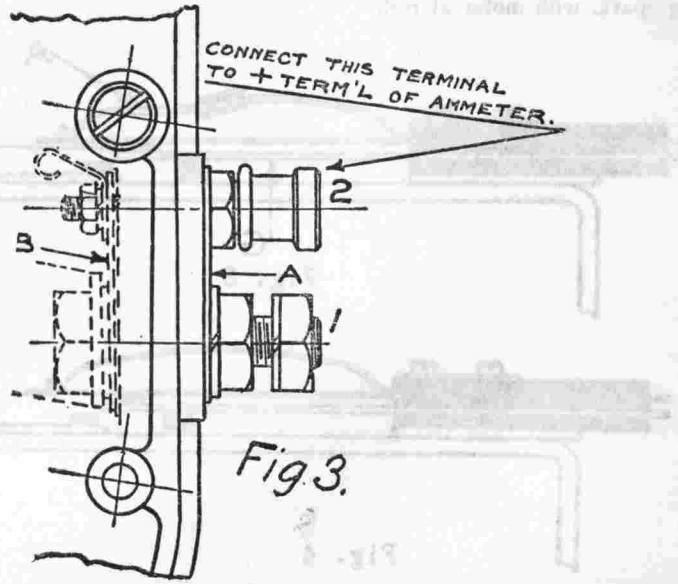


Fig. 3.

DELCO IGNITION RELAY

The ignition relay is in the dry cell circuit. It acts as a vibrator interrupting the current and sends a shower of sparks across the gap when the breaker contacts of magneto or distributor are open.

This relay consists of a set of contacts operated by an electro-magnet having two windings: One of coarse wire, in series with the contacts and a holding coil of very fine wire to hold the contacts open after circuit in large winding is broken.

The operation of this relay varies with the external connections. If connected as shown in Fig. 1, a series of sparks will be thrown across the gap as long as the circuit between Nos. 6 and 7 terminals (holding coil) is held open, by holding down button on switch, timing contacts being closed. If the button is released, completing holding coil circuit, a single spark just as a magneto or breaker system gives, is obtained.

Fig. 2 shows the method of connecting the ignition relay to the 1914 Delco Junior system. The ignition switch completes the primary circuit and holding coil circuit is completed by timer contacts. In this way a vibrating spark will be obtained all the time the timer contacts are open. This provides a late spark.

The following points should be borne in mind while adjusting the relay:—When armature is pressed down to open contacts "C" there should be absolutely no motion of the lower spring "G". Contacts open .005 inch.

Increasing the air gap between armature and core of upper coil decreases the tension of the spring A on contacts. If it is impossible to get a strong enough spark by adjusting the air gap slightly, it may be necessary to increase the tension of the spring. This may be done by holding the spring loosely in a pair of duck-bill pliers, pressing down slightly and at the same time twisting to the right as shown in Fig. 3. When properly adjusted it should have a bowlike shape, Fig. 4, free from the waves shown in Fig. 3. Care should also be taken to see that the armature makes a right angle (90°) and that it is free to move on its pin.

When properly adjusted the ignition relay should take .6 ampere when furnishing a vibrating spark, with motor at rest.

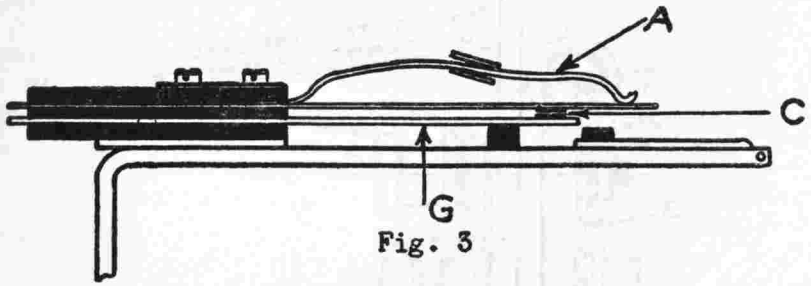


Fig. 3

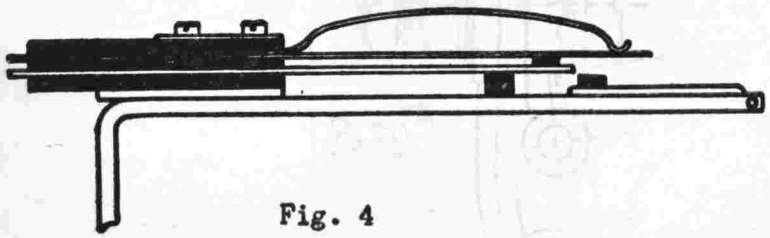


Fig. 4

Diagram showing how springs should look when properly "crowned"

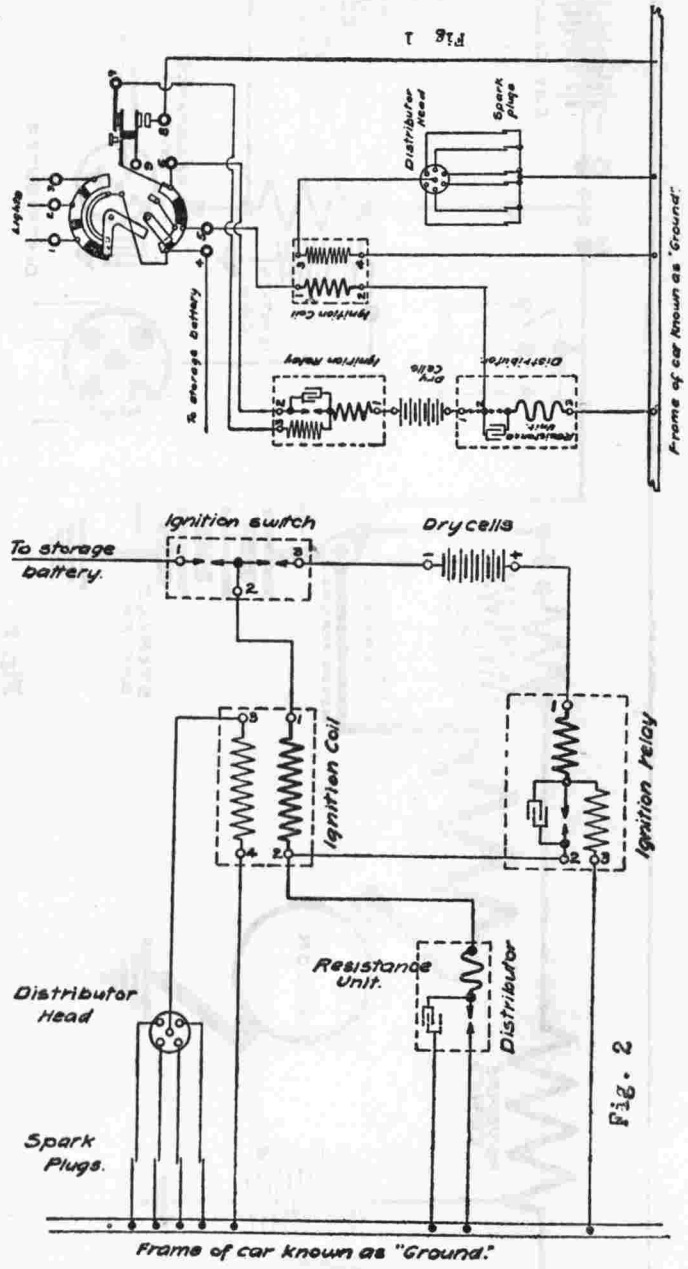


Fig. 2

Internal Circuits of the Delco Ignition Relay.

DISCO

GENERATING AND STARTING SYSTEM

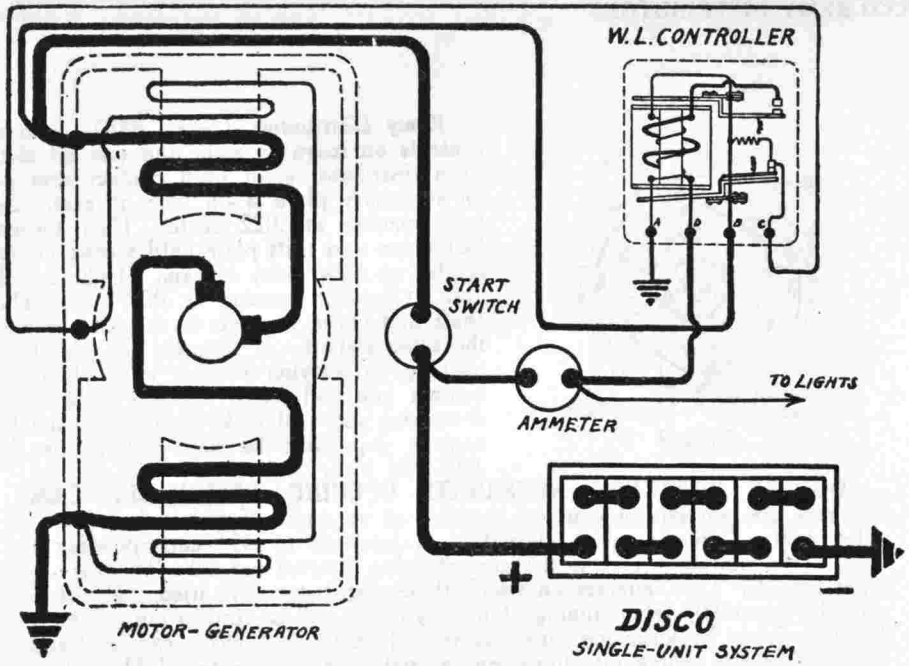
SINGLE UNIT SYSTEM

BATTERY.—Battery is 12 volt, 35 ampere-hour. Either the negative (—) terminal is grounded, or the two-wire system is used.

MOTOR-GENERATOR.—Starter and generator are combined into one unit. The unit is permanently connected to the engine crankshaft. There is a shunt and series field coil on two poles, the other poles carrying no windings. Generator current regulation is by vibrating regulator. Maximum current output is 10 amperes, reached at 15-20 miles per hour.

RELAY-REGULATOR.—Ward Leonard, Type CD. Relay closes at 7-10 and opens at 5-7 miles per hour. Charging current is 1-3 amperes at closing and the discharge current 0-1 ampere at the opening of relay contacts. Regulator spring tension is adjusted to limit the maximum current output to 10 amperes. Adjustment of both relay and regulator is made by bending the brass prongs which support the springs and determine the air gaps. Clean relay and regulator contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

OILING.—Put 5 or 6 drops of light engine oil in each of the starter-generator bearing oilers every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.



TWO-UNIT SYSTEM

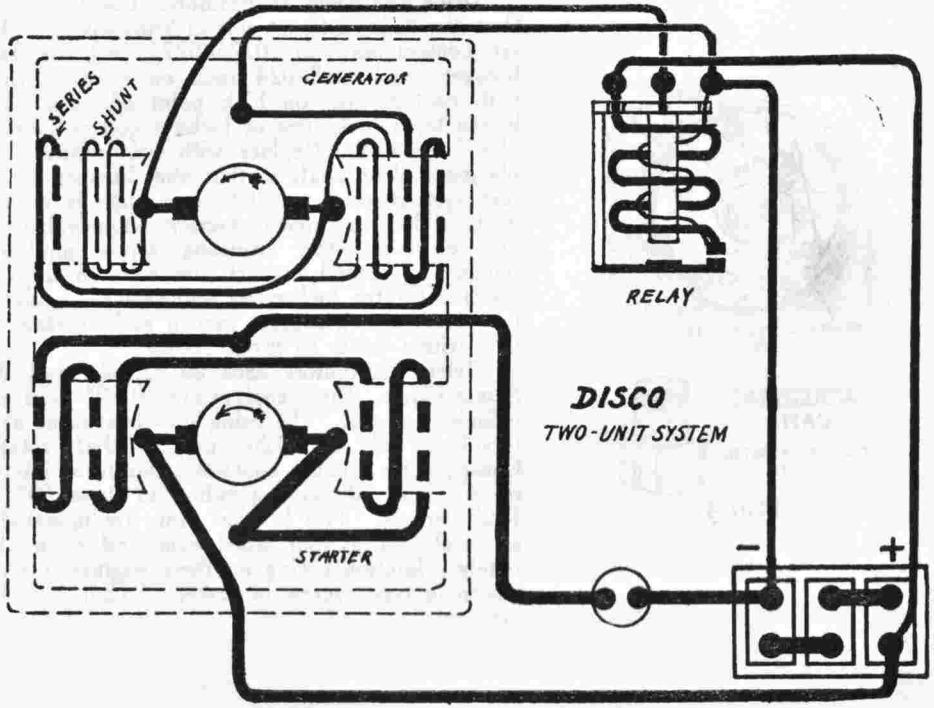
STARTER.—Starter is connected to the engine through reduction gears and overrunning clutch.

OILING.—Put 5 or 6 drops of light engine oil in each of the starter oilers every month.

GENERATOR.—Generator and starter are usually mounted one above the other. Generator has a series and shunt coil on each pole. Current regulation is by reverse series field. Maximum current output is 10 amperes, reached at 15-20 miles per hour.

OILING.—Put 5 or 6 drops of light engine oil in the generator bearing oilers every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

RELAY.—Briggs & Stratton. Relay closes at 8-10 and opens at 6-8 miles per hour. Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.



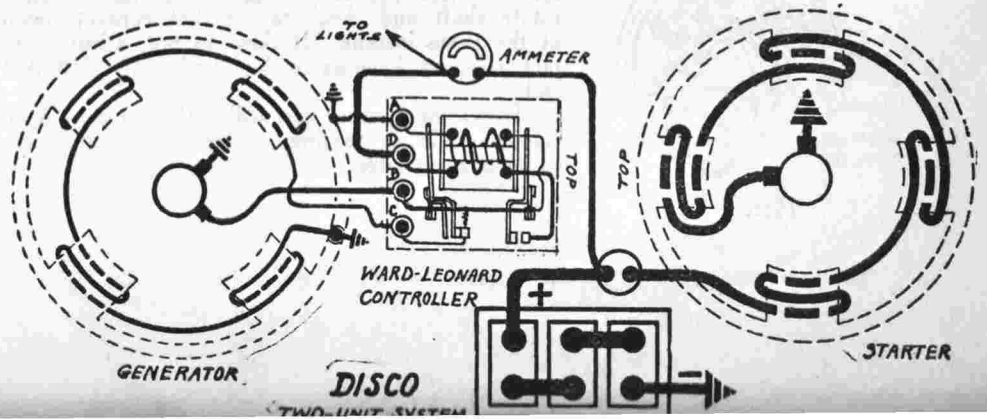
SYSTEM FOR FORD CARS

STARTER.—Starter is connected to the engine through a Bendix drive.

GENERATOR.—Generator current regulation is by Ward Leonard vibrating regulator.

RELAY-REGULATOR.—See information given above under Single Unit System. Normal maximum charging rate is 10 amperes. Circuits are shown below.

OILING.—See oiling instructions given for Two-Unit System.

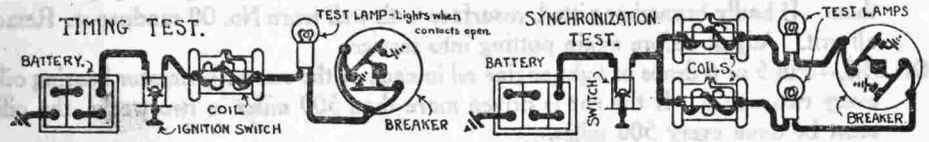


DISTRIBUTOR TIMING DIRECTIONS

DELCO, REMY AND DELCO-REMY DISTRIBUTORS

To accurately check breaker contact opening a lamp or some other device must be used. The eye is not sufficiently accurate to check the contact opening of breakers used on modern high speed distributors where the allowable variation in timing must not exceed 2 degrees of crankshaft rotation. A very accurate test may be made by wiring a six volt lamp in series with the primary circuit of the ignition coil. The lamp will thus remain lighted while the contacts are closed but will go out the instant the contacts open. To make these tests, solder flexible leads with clips attached to a 6-8 volt, 2 cp. bulb. Then disconnect primary lead at ignition coil and snap one clip on coil terminal and the other on the breaker lead. Where two coils are used it will be necessary to connect a lamp in the primary circuit of each coil.

Connections for making tests on various circuits are shown:



DOUBLE BREAKERS—SYNCHRONOUS OPERATION. Breakers using two sets of contacts operating on a single cam and opening at the same instant must be synchronized, which means both sets of contacts must open at the same instant. If this is not done the breaker contacts opening last will carry all the load and will burn up in service where the contacts are connected in parallel. Where double ignition is used one set of plugs will fire at the wrong time affecting ignition. However, in special cases manufacturers specify certain intervals of time between firing of plugs in double ignition systems and these intervals must be accurately set.

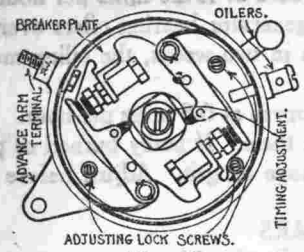


Plate 1

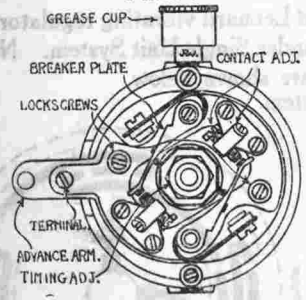


Plate 2

Delco Distributors. Set contact opening at correct figure recommended by manufacturer as given on car data sheets in the Reed Service Manual. Contact arm must be on lobe of cam. Turn distributor shaft until one set of contacts begin to separate. Then loosen three lockscrews on mounting plate and shift plate until second set of contacts also begin to separate. Tighten the lockscrews and proceed with the timing.

Remy Distributors (Series 648—with both sets of contacts on movable plate. Turn distributor shaft until one set of contacts is open with contact arm on lobe of cam. Loosen two lockscrews on mounting plate and shift plate until second contact arm is also on lobe of cam. Tighten lockscrews. Set contact opening .022 inch. Then rotate shaft and check to see that contacts open at the same instant. If they do not, adjust contact opening keeping within limits of .018-.024 inch.

Increasing contact gap will make contacts open sooner while decreasing contact gap will make contacts open later.

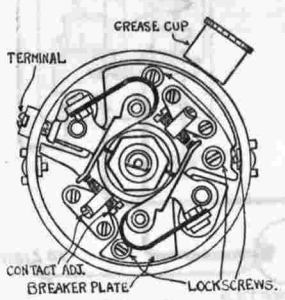


Plate 3

Remy Distributors (Series 648)—with one set contacts on movable plate and one set stationary. Turn distributor shaft until contact arm mounted on stationary plate is on lobe of cam. Set contact opening at .022 inch. Then loosen three lockscrews and shift plate until second contact arm is also on high point of cam. Tighten lockscrews and set contact opening at .022 inch. Then turn shaft and check contacts to see that they open at the same instant. If they do not, change contact opening by varying contact gap. Increasing the contact gap will make contacts open sooner and decreasing gap will make contacts open later. The contact gap must be kept within the limits of .018-.024 inch.

DOUBLE BREAKERS—ALTERNATE OPENING—REMOVABLE CAM. These breakers use two sets of contacts mounted at an angle of 45° and operate on a four sided cam. Contacts open alternately at intervals of 45° corresponding to 90° of crankshaft rotation. This is the correct firing interval for 90° 'V' type engines and eight cylinder 'Line' engines on which these distributors are used. The firing interval must be accurately set or timing of four cylinders will be thrown out. Timing on these breakers is set by loosening taper screw or locknut on breaker cam and shifting cam. For specific car timing directions see car data sheets in National Manual.

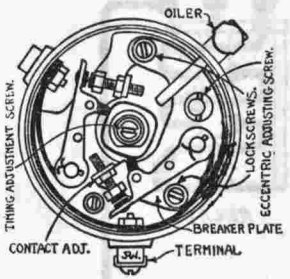


Plate 4

Delco and Remy Distributors. Use Delco-Remy Part No. 822572 to set correct firing interval. First set contact gap to .0225-.0275 inch on Delco breakers and .018-.024 inch on Remy breakers with contact arm on high point of cam. Then loosen taper lockscrew or locknut and remove regular firing cam. Replace with synchronizing tool, placing tool on shaft so that fiber bumper on contact arm mounted on stationary plate is in notch on tool. Loosen three lockscrews on movable plate and turn eccentric adjusting screw until fiber bumper of second contact arm rests in the other notch. Tighten lockscrews and replace regular firing cam. Check contact gap to make certain that it is within limits as given above.

Delco Distributors used on Lincoln and Wills Sainte Claire. These engines are 60° 'V' type eight cylinder engines. The firing impulses occur at intervals of 60° and 120° of crankshaft rotation. Consequently breaker contacts separate at intervals of 30° and 60° corresponding to these 60° and 120° periods. Two breaker arms are mounted on an angle on a four sided cam and open alternately. Ignition timing on these engines is set by loosening taper screw in center of cam and shifting cam.

DISTRIBUTOR TIMING DIRECTIONS

Continued from preceding page.

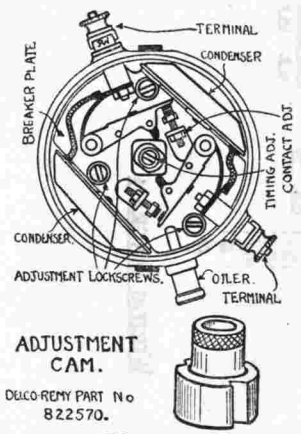


Plate 1

To set firing intervals use Delco-Remy Part No. 822570. First set contact gap at .0225-.0275 inch with contact arm on lobe of cam. Then loosen taper screw in center of cam and remove cam. Replace with synchronizing tool placing tool on shaft so that fiber bumper of one contact arm rests in notch in tool. Then loosen three lockscrews on plate and shift plate until bumper of second contact arm rests in the other notch of the tool. Then tighten lockscrews. Replace regular firing cam and check contact gap to see that it is within limits given above.

NEW TYPE DELCO-REMY DISTRIBUTORS—(Type 658)—With integral cam. These breakers have two sets of contacts operating on a four sided cam and opening alternately at intervals of 45° which corresponds to 90° of crankshaft rotation. This is the correct firing interval for the 90° 'V' type engines and eight cylinder 'Line' engines on which these units are used. Ignition timing on these breakers is done by loosening advance arm clamp screw and rotating distributor housing and breaker plate around cam. Cam is integral with upper distributor shaft.

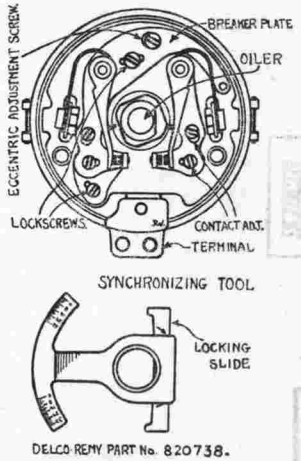
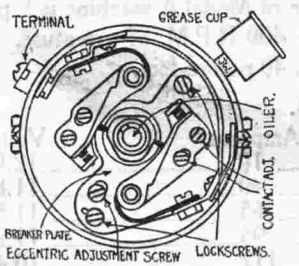


Plate 2

To set firing interval use Delco-Remy Part No. 820738. First check contact gap of both sets of contacts. Turn shaft until contact arm is on lobe of cam. Then loosen lockscrew and turn eccentric adjusting screw until contact gap is .022 inch. Tighten the lockscrew. After checking both contact gaps, place synchronizing tool over cam locking it in place by pushing slide tight so that arrow visible on slide points in direction of rotation. Turn shaft in direction of rotation until stationary set of contacts open. Note reading on leading side of tool which is opposite the edge of the terminal block on edge of distributor cup. Continue to turn shaft until the same reading on the second scale is opposite the same point on distributor cup. Loosen two lockscrews and turn eccentric adjusting screw until second set of contacts separate. Tighten lockscrew. Check contact opening with contact arm on lobe of cam. It must be within limits of .018-.024 inch. If it is not, reset contact gap at .022 and repeat synchronizing operation. Tool scales are graduated in degrees of engine rotation. The allowable variation is 2°.

NEW TYPE DELCO-REMY DISTRIBUTOR—(Type 656)—with integral cam. These breaker have two sets of contacts with a three sided cam opening alternately at intervals of 60° corresponding to 120° of crankshaft rotation. This is the correct firing interval for the six cylinder engines on which this unit is used. Ignition timing on these breakers is done by loosening advance arm clamp screw and rotating distributor housing and breaker plate around cam. Cam is integral with upper distributor shaft.



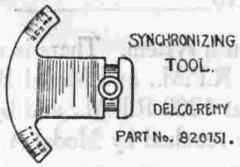


Plate 3

To set firing interval use Delco-Remy Part No. 820751. First check contact gap of both sets of contacts. Turn shaft until contact arm is on lobe of cam. Then loosen lockscrew and turn eccentric adjusting screw until contact gap is .022 inch. Tighten the lockscrew. After checking both sets of contacts, place synchronizing tool over cam with left hand spring in slot in shaft for clockwise rotation and the right hand spring in the slot for counter-clockwise rotation. Then turn shaft in direction of rotation until stationary contacts separate. Note reading on leading scale of tool opposite the approaching edge of the slot in the edge of the distributor cup. Continue to rotate shaft until the same reading on the other scale is opposite the same point on the distributor cup. Loosen the two lockscrews on the mounting plate and turn eccentric adjusting screw until the second set of contacts begin to separate. Tighten the lockscrews and check contact gap with contact arm on lobe of cam. It must be within limits of .018-.024 inch. If it is not, reset gap to .022 inch and repeat synchronizing operation. The tool scale is graduated in degrees of engine rotation. The allowable variation is 2°.

Dyneto

MODELS A AND B

SINGLE UNIT GENERATING, STARTING AND LIGHTING SYSTEM

BATTERY.—Battery is 12 volt, 50-70 ampere hour. The negative (—) terminal is grounded on cars using grounded system.

STARTER.—Starter and generator are combined to form a single unit. Armature is permanently chain connected to engine crankshaft. There are two different size machines—Model A and a larger Model B. Torque of Model A machine is 8 pound-feet and torque of Model B is 7½ pound-feet, at 400 R.P.M. of armature. Lock torque of Model A is 30 pound-feet and of Model B, 40 pound-feet.

Starter Data.—Model B.

Torque	R.P.M.	Amperes	Volts
0 lb. ft.	800	10	12.0
5 lb. ft.	425	40	11.8
10 lb. ft.	300	65	11.5
15 lb. ft.	230	95	11.2
20 lb. ft.	175	112	10.4
25 lb. ft.	110	140	10.2
30 lb. ft.	75	160	10.2
40 lb. ft.	Lock	210	9.6

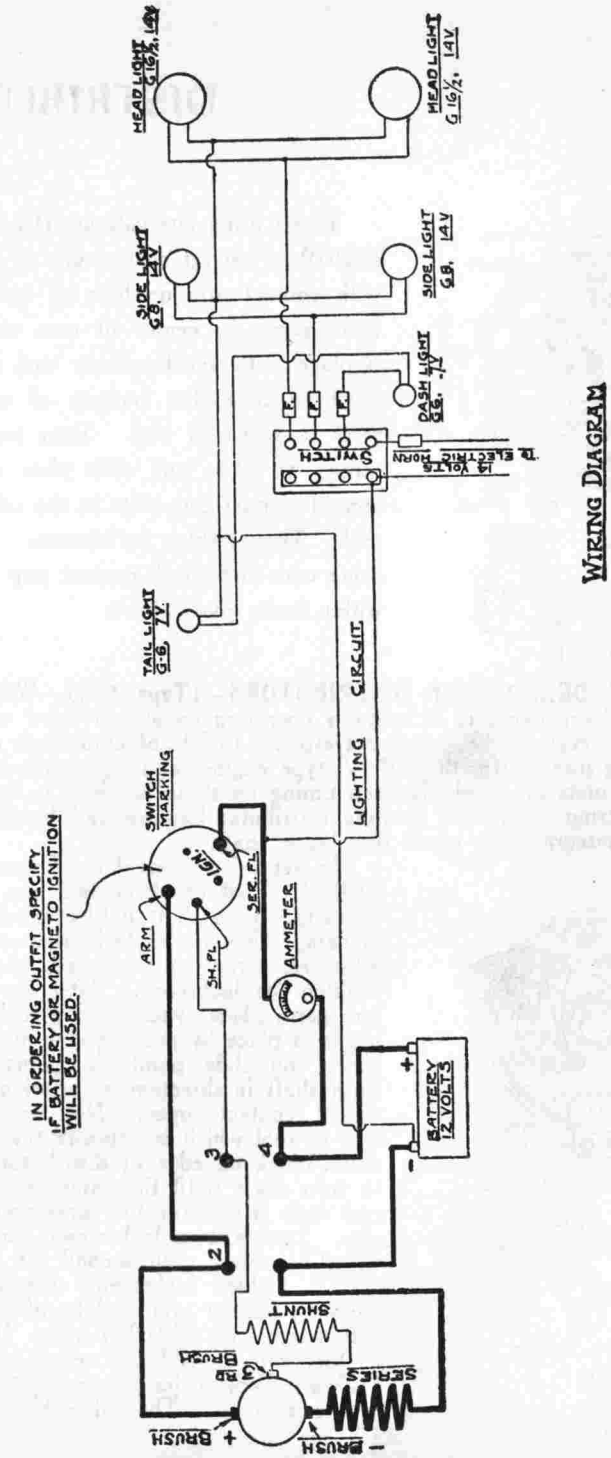
GENERATOR.—Generator current regulation is by third brush system. There is no relay. Generator Model A begins to supply current at 1000 R.P.M., and Model B at 900 R.P.M. Output of 5 amperes is reached by Model A at 1200 R.P.M., and by Model B at 1150 R.P.M. Maximum output of 10 amperes is reached by Model A at 1600 R.P.M., and by Model B at 1400 R.P.M., of armature.

Generator Data. Model B.

Amperes	M.P.H
0.0	7.5
5.0	9.0
7.5	10.0
10.0	12.5
12.5	17.5
10.0	27.5
6.0	50.0

OILING.—Put several drops of light engine oil in each of starter-generator bearing oilers every two weeks. If car is driven more than 500 miles in two weeks, oiling must be done every 500 miles.

LAMPS.—Head lamps are 14-16 volt, 15-24 cp. Side or dimmer lamps are 12-14 volt, 4-6 cp. Dash and tail lamps are in series. They are each 6-8 volt, 2 cp.



WIRING DIAGRAM

DYNETO MODELS A AND B, SINGLE UNIT SYSTEM.

Models UA and VA

Two Unit Generating, Starting and Lighting System

Battery.—Battery is 6 volt, 80-130 ampere-hour. The negative (—) terminal is grounded when the grounded system is used.

Starter.—Model UA. Starter is connected to engine through a Bendix drive.

STARTER DATA

Torque	R. P. M.	Amperes	Volts
0 lb. ft.	3000 +	40	5.6
2.5 lb. ft.	1350	160	5.2
5.0 lb. ft.	650	280	4.7
7.5 lb. ft.	300	380	4.4
10.0 lb. ft.	Lock	480	4.0

Oiling.—Put several drops of light engine oil on the felt washer at commutator end and the felt wick at driving end every month.

Generator.—Model VA. Generator current regulation is by a vibrating regulator. Generator begins to supply current at 7-9 miles per hour. Maximum current of 10-12 amperes is reached at 14-16 miles per hour.

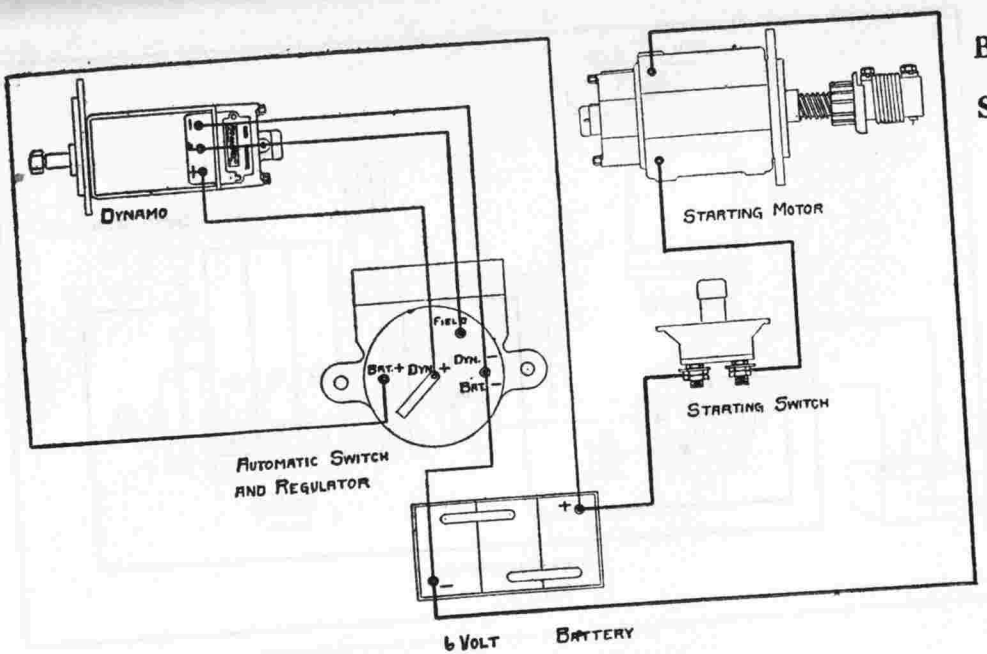
GENERATOR DATA

Amperes	M. P. H.
0	8
5	11
10	13
12	15
10	40

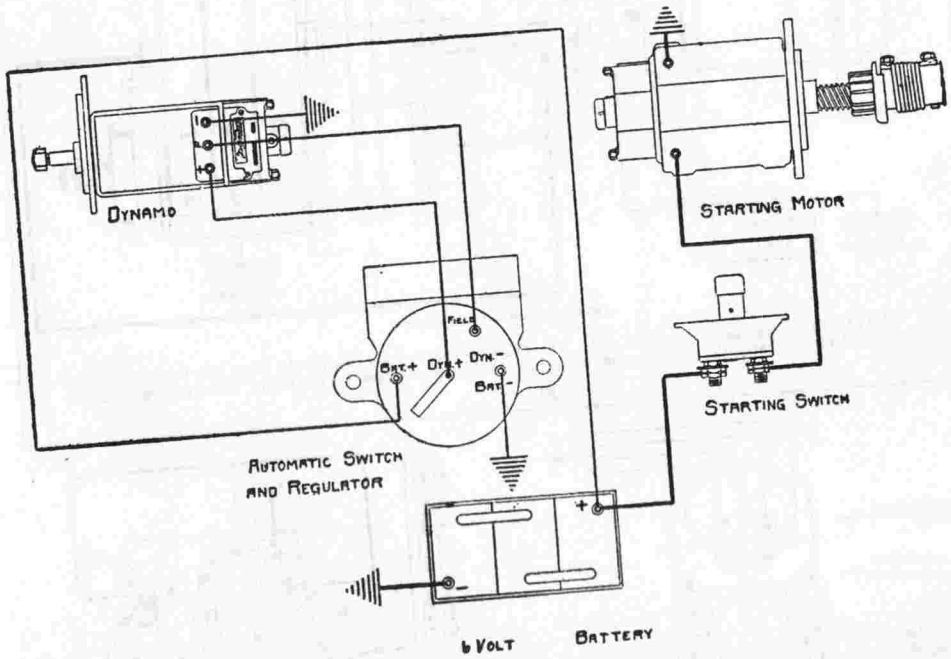
Oiling.—Put several drops of light engine oil on felt washer at commutator end and the felt wick at driving end every month. If car is driven more than 1000 miles in a month, oiling must be done every 1000 miles.

Relay.—Relay and regulator are combined into one unit. Relay closes at 7-9 and opens at 5-7 miles per hour. Charging current is 1-3 amperes at closing and the discharge current 0-1 ampere at opening of relay. Clean relay and regulator contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sand paper. Remove all grit. Adjust before again putting into service.

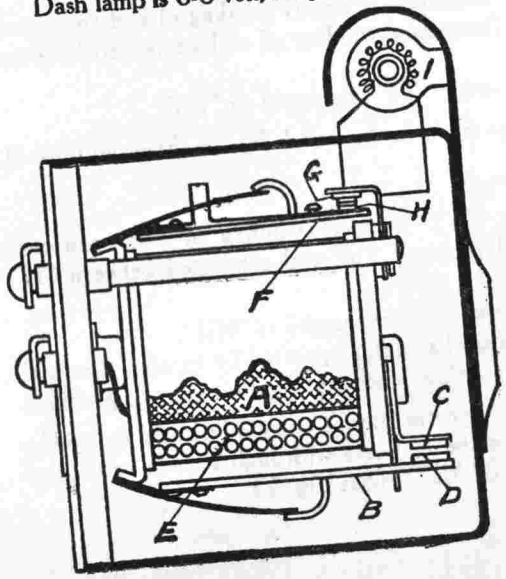
Lamps.—Head lamps are 6-8 volt, 15-24 cp. Side or dimmer lamps are 6-8 volt, 4-6 cp. Dash lamp is 6-8 volt, 2 cp. Tail lamp is 6-8 volt, 2 cp.

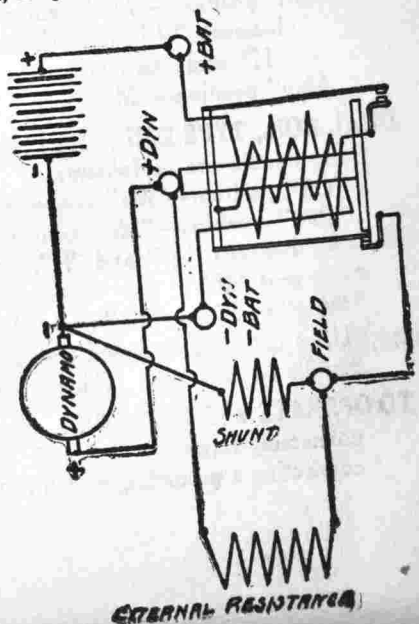


Wiring Diagram for Two Wire System



Wiring Diagram for One Wire System





EISEMANN MAGNETO

TYPES EA, EU AND ED, SINGLE SPARK, INDEPENDENT AND DUAL

ROTATION.—Direction in which magneto must be driven is indicated by an arrow at the drive end.

BREAKER.—Breaker contacts separate .016 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 2 or 3 drops of light engine oil in each of the oil wells every month. Apply a small amount of vaseline to the fiber bumper of the contact arm, with a toothpick. If the car is driven more than 1000 miles in a month, these attentions must be given every 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Place the breaker housing in the fully retarded position by turning it as far as it will go in the direction of armature rotation. Turn the armature shaft in the direction in which the magneto is to be driven until the breaker contacts are just beginning to separate. Couple the magneto to the engine, being careful not to disturb the relative position between the armature shaft and the driving member. Determine which distributor terminal is in contact with the distributor brush, and connect that terminal with the plug in No. 1 cylinder. Connect the other terminals and plugs in accordance with the firing order of the engine. On the dual type of magnetos, the battery breaker contacts separate 10° later than the magneto breaker contacts.

SPARK PLUG GAPS.—Spark plug gaps are .016 inch.

DUAL COIL, TYPE DT.—The connections made by the switch in the three positions are as follows:

"Off" position—"Ma" connected to "Ground". "+" open.

"Batt" position—"Ma" connected to "Ground". Primary winding of coil connected between "+" and "Ground". Secondary winding of coil connected between "H" and "Ground".

Mag" position—"Ma" open. "+" open. "H" connected to "HM"

DUAL COIL, TYPE D2U.—The connections made in the switch for the three positions of the handle are as follows:

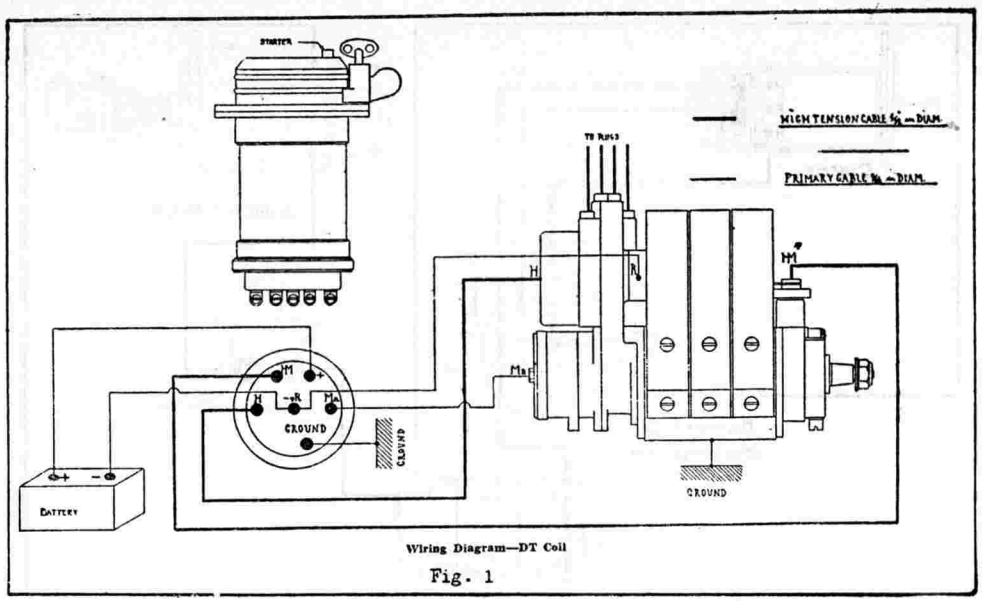
"Off" position—"Ma" connected to "M". "+" open.

"Batt" position—"Ma" connected to "M". Primary winding of coil connected between "+" and "R". Secondary winding of coil connected between "H" and "M".

'Mag" position—"Ma" open. "+" open. "H" connected to "HM".

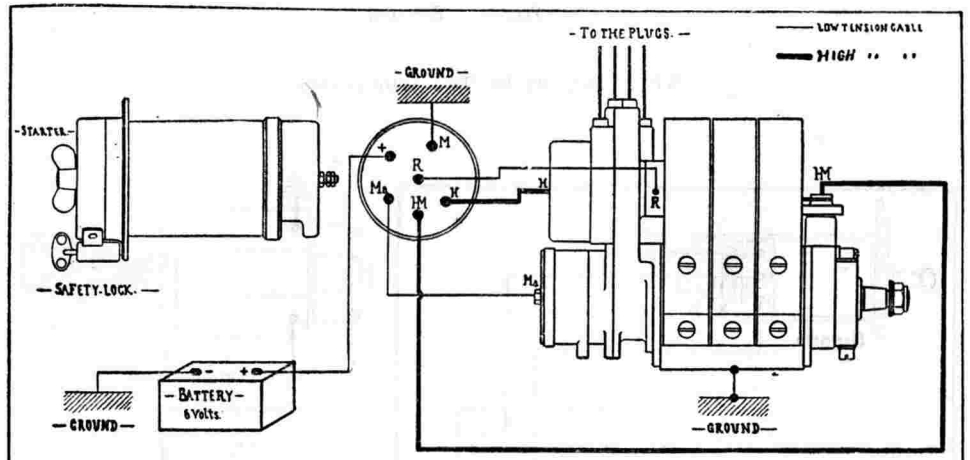
These coils are equipped with a mechanical vibrator operated by turning the small handle on coil face. This device aids starting, when no electric starter is provided.

TO OPERATE WITHOUT COIL.—The dual magnetos may be operated without the coil by connecting terminals "H" and "HM" on the magneto with high tension cable, and connecting a grounding switch to terminal "Ma". (See Fig. 4.)



Wiring Diagram—DT Coil

Fig. 1



Wiring Diagram D2U—DCR Coils

NOTE.—This cut shows the D2U coil. The DCR connections are exactly the same, but the terminals on the bottom of the coil, according to the symbols, occupy different positions on the plate Wire according to the symbols.

Fig. 2

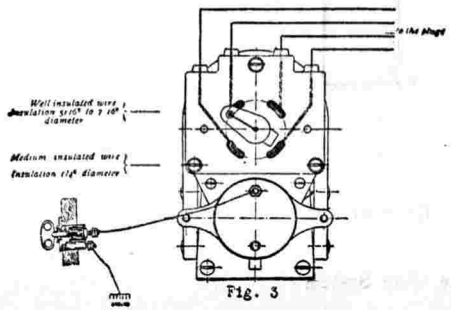


Fig. 3

Wiring Diagram—Key Switch—Single Ignition

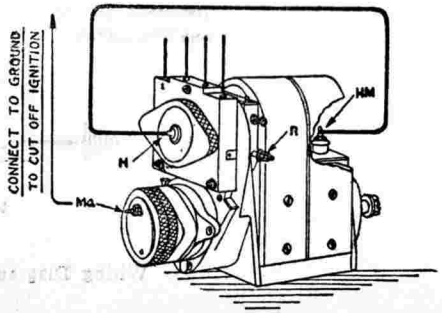
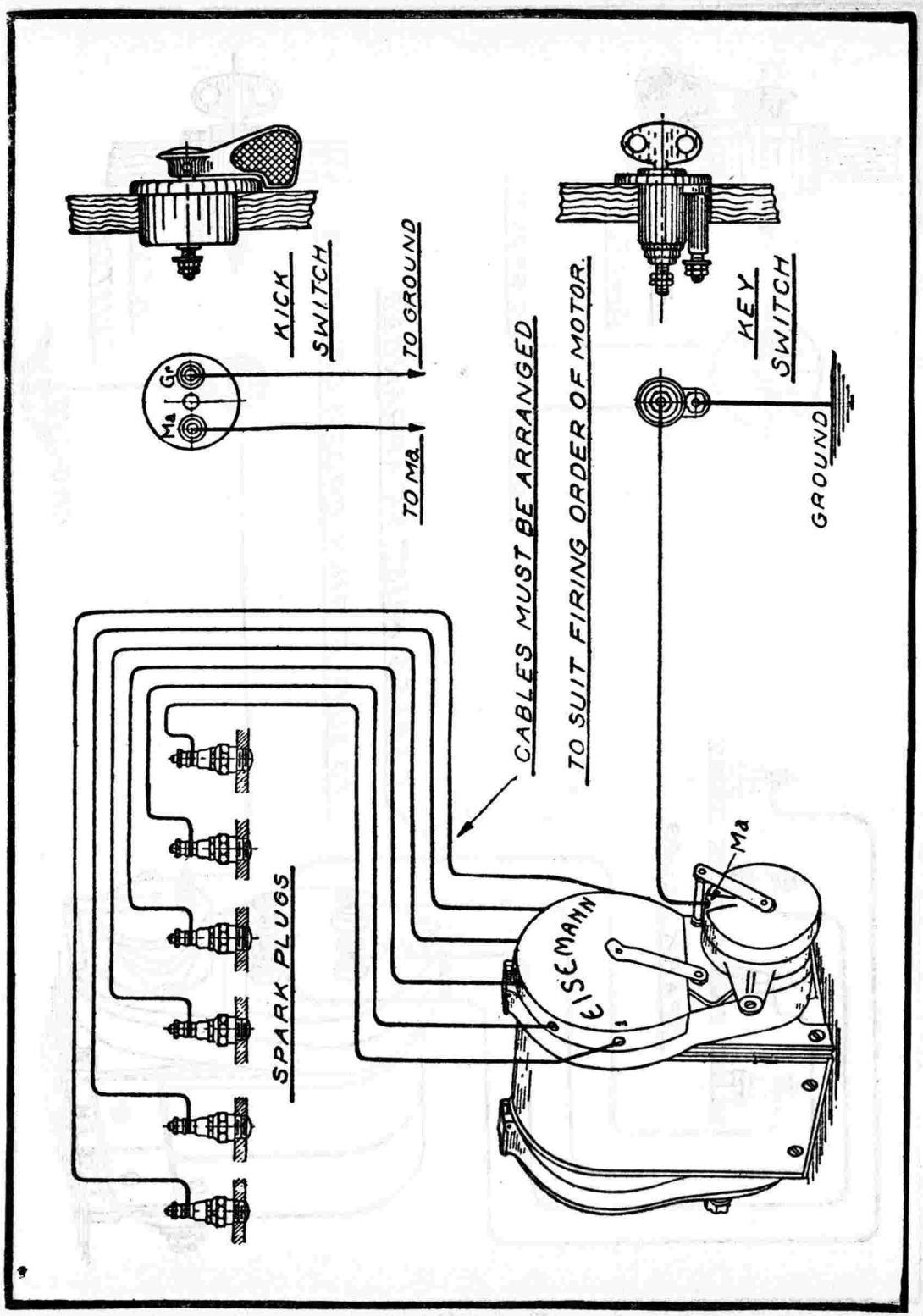


Fig. 4



EISEMANN MAGNETO

TYPE GN-6, SINGLE SPARK, INDEPENDENT

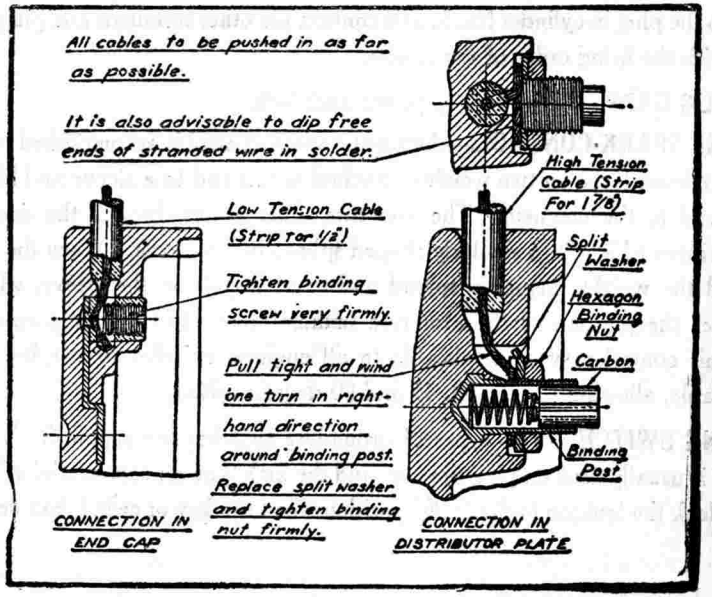
BREAKER CONTACTS.—Breaker contacts separate .015 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 1 or 2 drops of light engine oil in each of the magneto oilers every month. If the car is driven more than 1000 miles in a month, the oiling must be done ever 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the spark is desired to occur. Remove the distributor block and turn the armature shaft until the setting mark on the distributor disc is in line with the indicator. Use the setting mark "R" if magneto rotation is clockwise (drive end), and "L" if counter-clockwise. In this position of the armature and with the breaker housing fully retarded, the breaker contacts are just separating. Couple the magneto to the engine, being careful to maintain the exact relative position between magneto shaft and driving member.

SPARK PLUG GAPS.—Spark plug gaps are .030 inch.

CONNECTING CABLES.—Plate 150A shows the method of fastening the high tension cables and the grounding wire.



EISEMANN MAGNETO

TYPES EMA-4 AND EMA-6, SINGLE SPARK, INDEPENDENT

ROTATION.—The direction in which the magneto must be driven is indicated by an arrow at drive end.

BREAKER.—Breaker contacts separate .015 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or well worn No. 00 sandpaper.

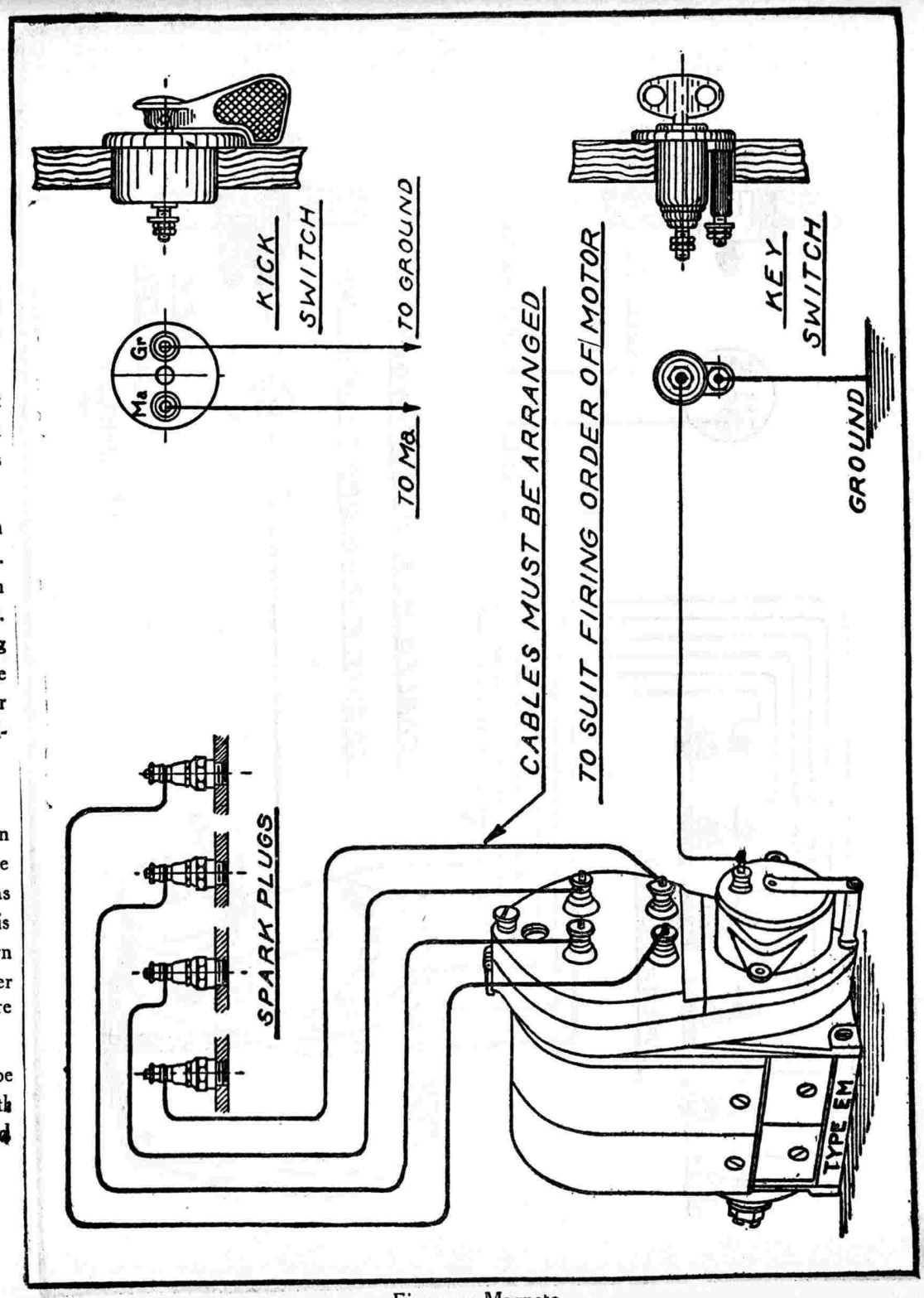
OILING.—Put 2 or 3 drops of light engine oil in each of the oil wells every month. Put a small amount of vaseline on the fiber bumper of the contact arm, applying with a toothpick. If the car is driven more than 1000 miles in a month, these attentions must be given every 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Turn the magneto shaft until "No. 1" appears in the glass dial in the distributor plate. Then insert the special key in the slot in the rear of the governor housing to lock the armature shaft in this position. With the breaker assembly fully retarded, the breaker contacts must be just beginning to separate. Couple the magneto to the driving member. Remove the key before any attempt is made to drive the magneto. Connect No. 1 terminal on the distributor plate to the plug in cylinder No. 1, and connect the other terminals and plugs in accordance with the firing order of the engine.

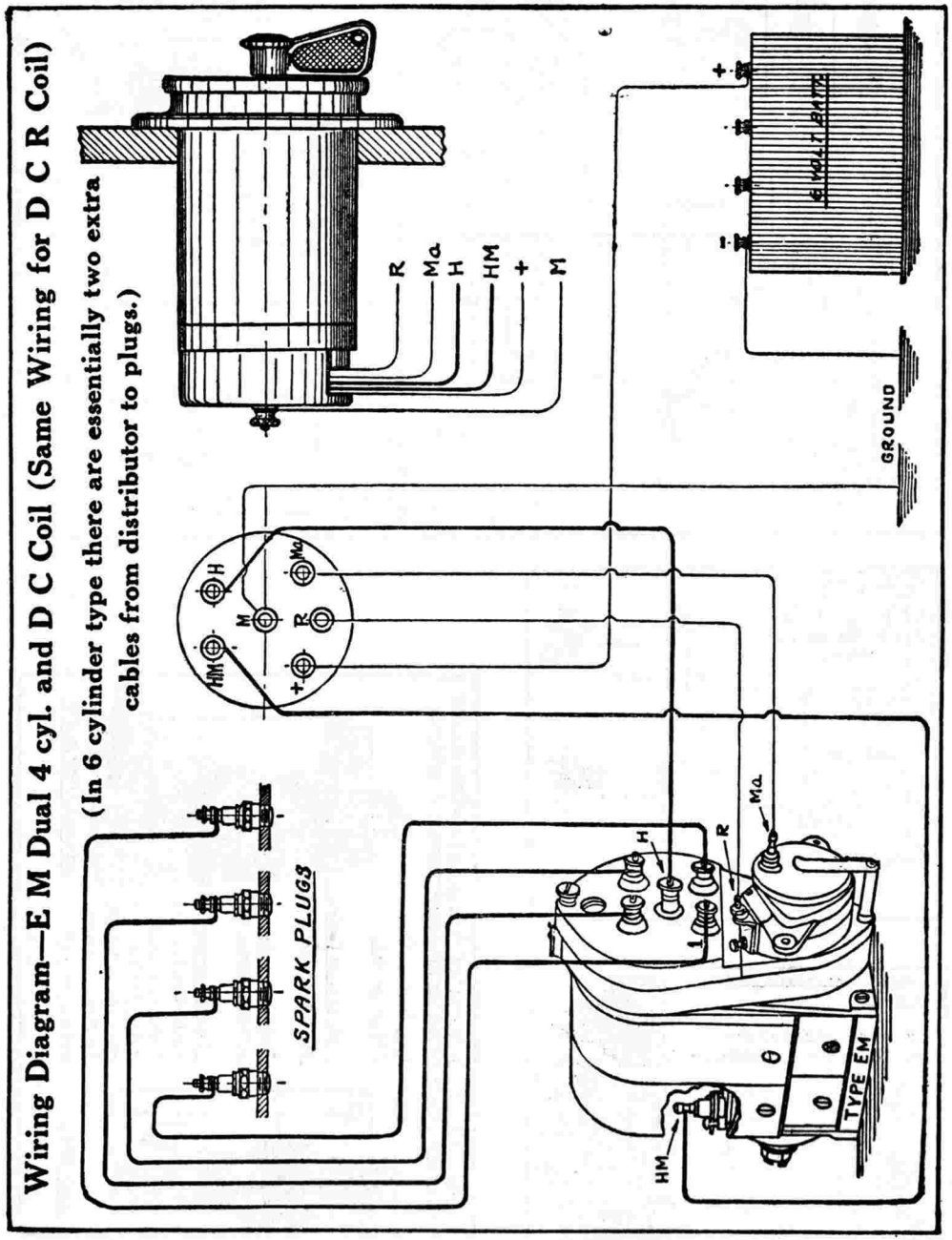
SPARK PLUG GAPS.—Spark plug gaps are .016 inch.

AUTOMATIC SPARK CONTROL.—Automatic spark control is accomplished by the action of centrifugal force on two weights attached at one end to a sleeve and hinged at the other end to the magneto. The armature shaft passes through the sleeve and has spiral ridges which fit in similarly shaped splines in the sleeve. When the armature is rotated the weights begin to spread and exert a pull on the sleeve, which in turn changes the position of the armature with reference to the pole pieces. In order that this control may be applicable to all engines, spindles of varying pitches are obtainable, allowing 19, 25, 38, 45 and 60 degrees advance.

GROUNDING SWITCH.—Two types of grounding switches are supplied. The key type switch is usually used on pleasure cars and the kick type on commercial vehicles. Both types lock the ignition in the "Off" position when the key or switch handle is removed



Eisemann Magneto



EISEMANN MAGNETO

TYPES EM-4 AND EM-6, SINGLE-SPARK, DUAL

ROTATION.—Direction in which magneto must be driven is indicated by an arrow on the oil hole cover at the drive end.

BREAKER.—Breaker contacts separate .015 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 3 or 4 drops of light engine oil in each of the oil wells every month. Apply a small amount of vaseline to the fiber bumper of the contact arm, with a toothpick. If the car is driven more than 1000 miles in a month, these attentions must be given every month.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Place the breaker assembly of the magneto in the fully retarded position by turning it as far as it will go in the direction of rotation of the armature. Turn the armature until the figure No. 1 appears at the glass dial in the distributor plate. With the armature in this position, the breaker contacts must be just beginning to separate. Couple the magneto to the engine, being careful not to disturb the relative position between the magneto shaft and driving member. The battery breaker contacts separate 10° later than the magneto breaker contacts. This is to insure a retarded spark for starting.

SPARK PLUG GAPS.—Spark plug gaps are .016 to .030, depending upon the characteristics of the engine.

COMBINED COIL SWITCH.—Types DC and DCR. The connections made by the switch in the three positions of the handle are as follows:

"Off" position—"Ma" connected to "M". "+" open. "R" open.

"Batt" position—"Ma" connected to "M". "+" connected to "R" through the primary winding of the coil. Secondary winding of coil connected between "M' and "H".

"Mag" position—"Ma" open. "H" connected to "HM". "+" open.

Type DCR Coil is equipped with a mechanical vibrator which supplies a shower of sparks for starting. The Type DC Coil has a push button, enabling the operator to cause a single spark to occur in the plug which is connected to the coil through the distributor.

TO OPERATE WITHOUT COIL.—Magneto may be operated as an independent type by connecting terminals "HM" and "H" on the magneto with high tension cable. Remove the wires from terminals "H" and "R". The wire from terminal "Ma" must connect with a grounding switch in order to render the magneto inoperative when it is desired to stop the engine.

EISEMANN MAGNETO

TYPES G4, G4-I. EDIT, G4-II EDIT., SINGLE-SPARK, INDEPENDENT
TYPE GR4-II EDIT., SINGLE-SPARK, DUAL

ROTATION.—The direction in which the magneto must be driven is indicated by an arrow on the drive end.

BREAKER.—Breaker contacts separate .010 to .012 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Independent Types. Put 1 or 2 drops of light engine oil in each of the oil wells every month. If the car is driven more than 1000 miles in a month the oiling must be done every 1000 miles.

OILING.—Dual Type. Put 1 drop of light engine oil in the oil well at the breaker end every month. Put 15 drops in the large oil hole at the drive end and 4 or 5 drops in the smaller oil hole. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Remove the distributor plate from the magneto and turn the shaft until the setting mark on the disc is in line with the indicator. If magneto rotates clockwise (drive end) use the setting mark "R", and if counter-clockwise, use the setting mark "L". With the armature in this position, and the breaker assembly fully retarded, the breaker contacts must be just beginning to separate. Couple the magneto to the engine, being careful not to disturb the relative position between the armature shaft and the driving member. Connect distributor terminal marked "1" to the plug in No. 1 cylinder. Connect the other terminals in accordance with the firing order of the engine. On the Dual Type Magneto, the battery breaker contacts separate 10° later than the magneto breaker contacts, to insure a retarded spark for starting.

SPARK PLUG GAPS.—Spark plug gaps are .015 to .030 inch, depending upon the characteristics of the engine.

CONNECTED CABLES.—The special method of connecting the high tension cables and grounding wire are shown in Plate 153B for the Independent Types, and in Plate 153C for the Dual Type.

DUAL COIL.—Types DC and DCR. The connections made by the switch in the three positions of the switch handle are as follows:

"Off" position—"Ma" connected to "M". "+" open.

"Batt" position.—"Ma" connected to "M". "+" connected to "R", through the primary winding of the coil. "H" connected to "M" through the secondary winding of the coil.

"Mag" position—"Ma" open. "H" connected to "HM". "+" open.

TO OPERATE WITHOUT COIL.—The dual type magneto may be operated as an independent type by connecting terminals "HM" and "H" on the magneto with high tension cable. Remove the wires from terminals "H" and "R". The wire from terminal "Ma" must connect with a grounding switch in order to render the magneto inoperative when it is desired to stop the engine.

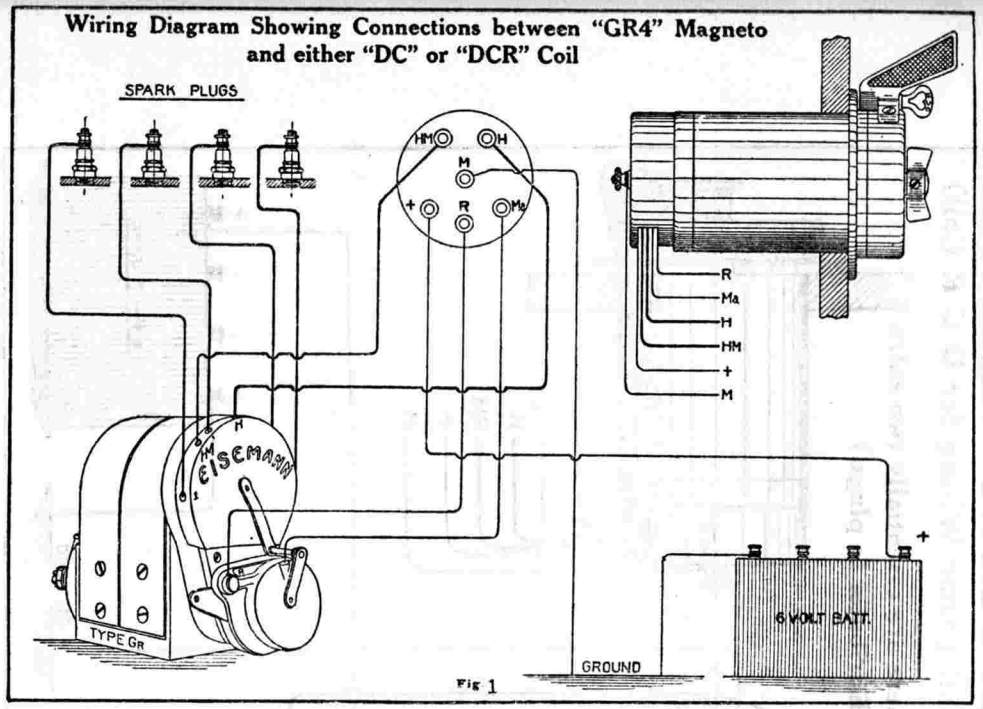


Fig 1

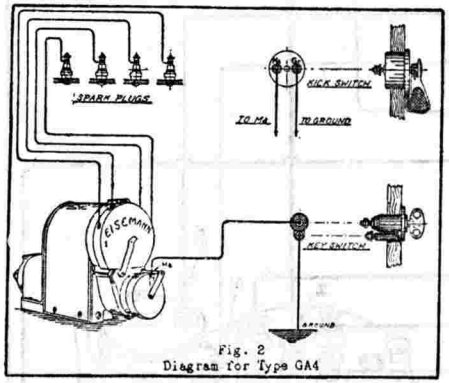


Fig. 2
Diagram for Type GA4

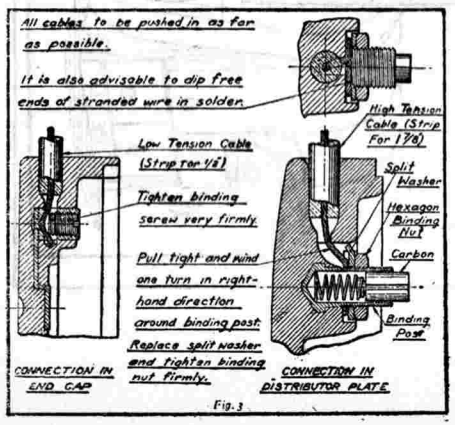


Fig. 3

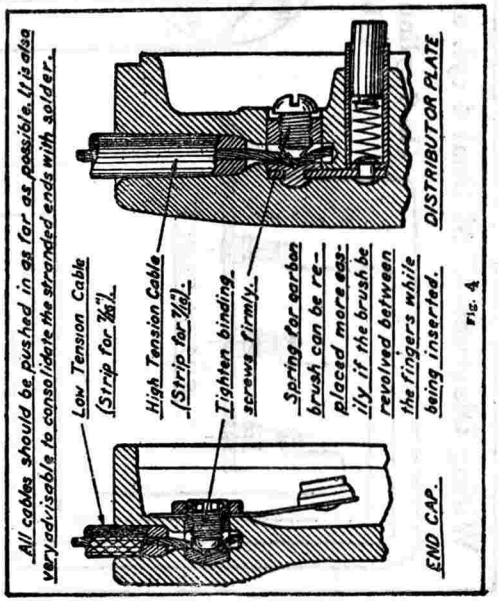
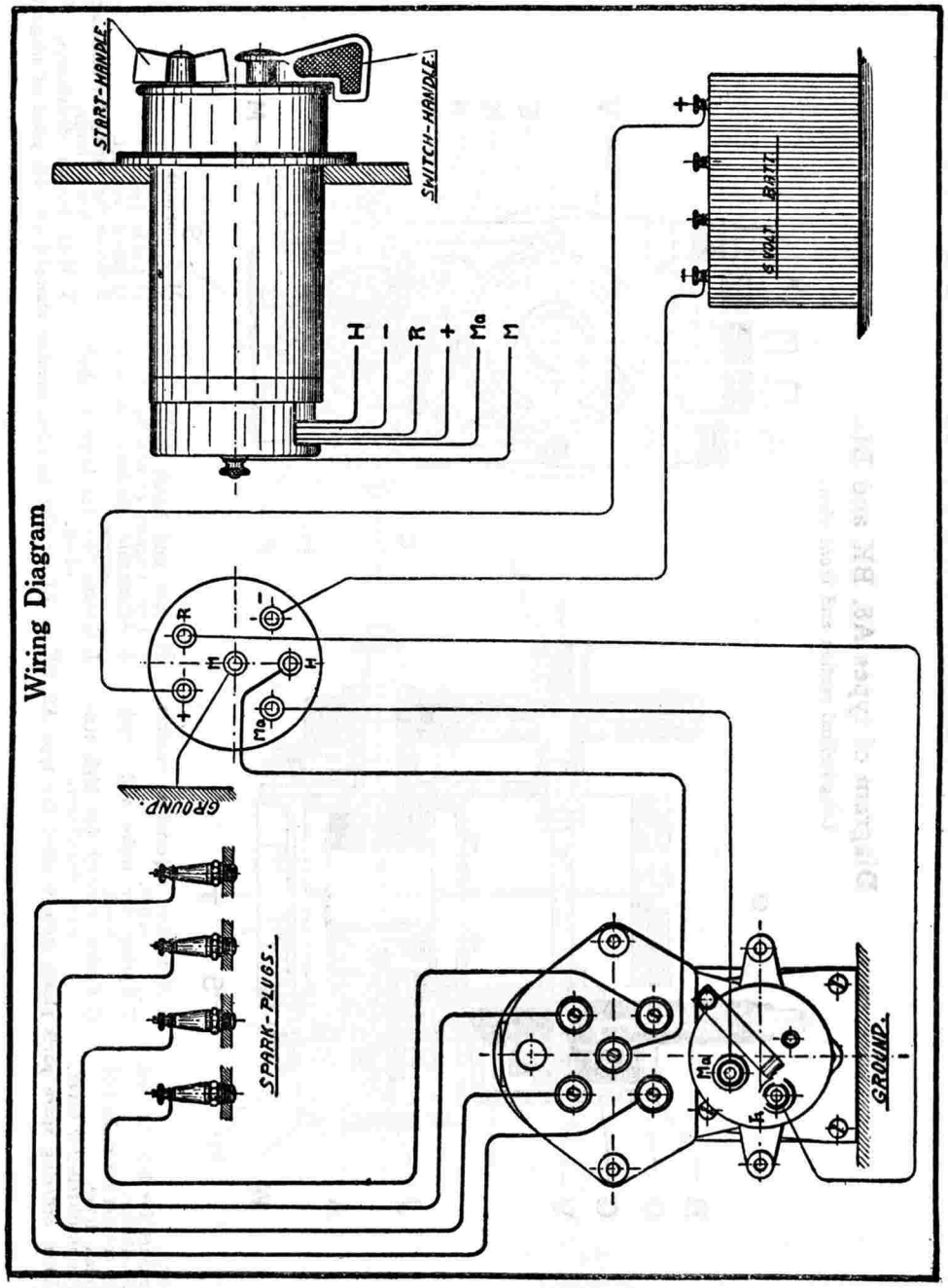


Fig. 4



EISEMANN MAGNETO

TYPE EB-4, SINGLE-SPARK, DUAL

ROTATION.—The direction in which the magneto must be driven is indicated by an arrow on the drive end.

BREAKER.—Breaker contacts separate .016 to .030 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 2 or 3 drops of light engine oil in each of the oil wells every month. Put a small amount of vaseline on the fiber bumper of the contact arm, applying with a toothpick. If the car is driven more than 1000 miles in a month, these attentions must be given every 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Place the breaker assembly of the magneto in the fully retarded position by turning as far as it will go in the direction of armature rotation. Turn the armature shaft until "No. 1" appears at the glass dial in the distributor plate. With the armature in this position, the breaker contacts must be just beginning to separate. Couple the magneto to the engine, being careful not to disturb the relative position of the armature shaft and driving member. The battery breaker contacts separate 10° later than the magneto breaker contacts.

SPARK PLUG GAPS.—Spark plug gaps are .015 to .030 inch, depending upon the characteristics of the engine.

COMBINED SWITCH AND COIL.—Type BD. The connections made by the switch in the three positions of the handle are as follows:

"Off" position—"Ma" open. "+" and "—" open.

"Batt" position—"Ma" open. "—" connected to "R". Primary winding of coil connected between "+" and "M". Secondary winding of coil connected between "H" and "M".

"Mag" position.—Primary winding of coil connected between "Ma" and "R". Secondary winding of coil connected between "H" and "M". "+" and "—" open.

This magneto is of the low tension type and cannot be operated without the coil.

EISEMANN MAGNETO

TYPES A8, BK AND BL, LOW TENSION, SINGLE-SPARK, INDEPENDENT OR DUAL

ROTATION.—Direction in which magneto must be driven is indicated by an arrow on the gear wheel case.

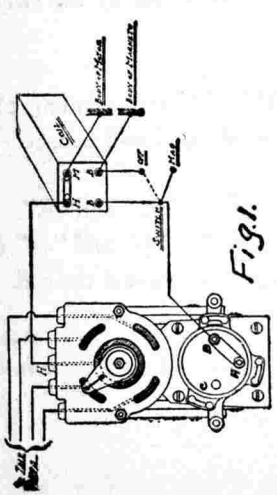
BREAKER.—Breaker contacts separate .015 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

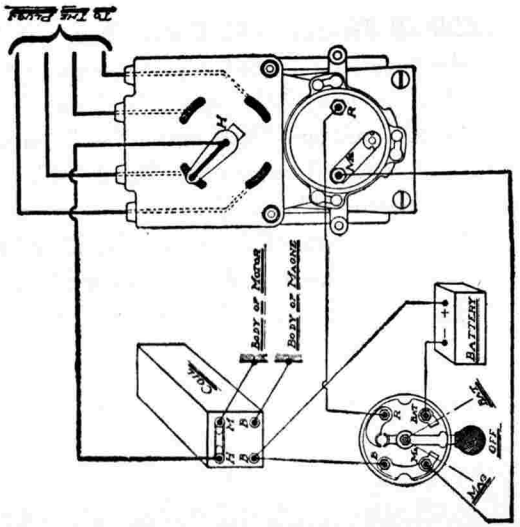
OILING.—The grease cup at the end of the distributor driving gear shaft must be kept filled with soft cup grease. Put 3 or 4 drops of light machine oil in the wick oilers every month. If the car is driven more than 1000 miles in a month, these attentions must be given every 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in cylinder No. 1 is in the position where the fully retarded spark is desired to occur. Place the breaker housing in the fully retarded position by turning it as far as it will go in the direction of armature rotation. Turn the magneto armature shaft until the breaker contacts are beginning to separate. Couple the magneto to the engine, being careful not to disturb the relative position between armature shaft and driving member. Determine which terminal of the distributor is in connection with the distributor brush, and connect that terminal with plug in No. 1 cylinder. Connect the other plugs and terminals in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .016 inch.

OPERATION.—The connections when operating as an independent type are shown in Plate 155A. By the use of a special switch, the same magneto and coil may be used to provide dual ignition. Connections are shown in Plate 155B. The brass bar on the breaker box, which connects terminals "A" and "B" on the independent type, must be altered to connect terminals "A" and "C".

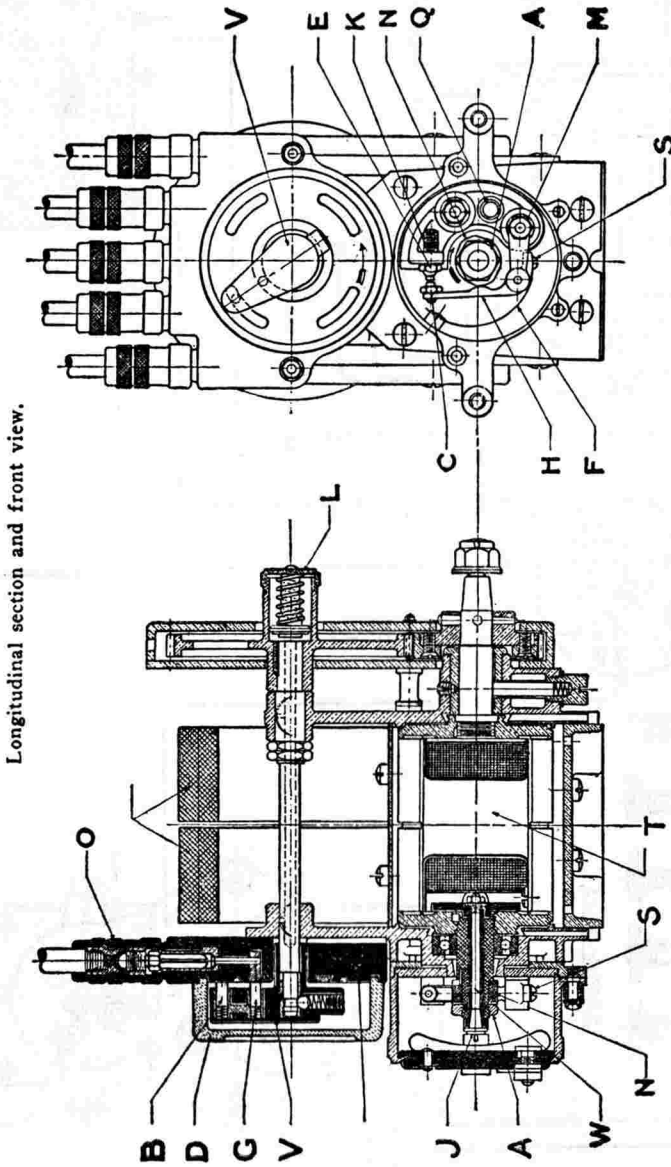




Single Ignition.

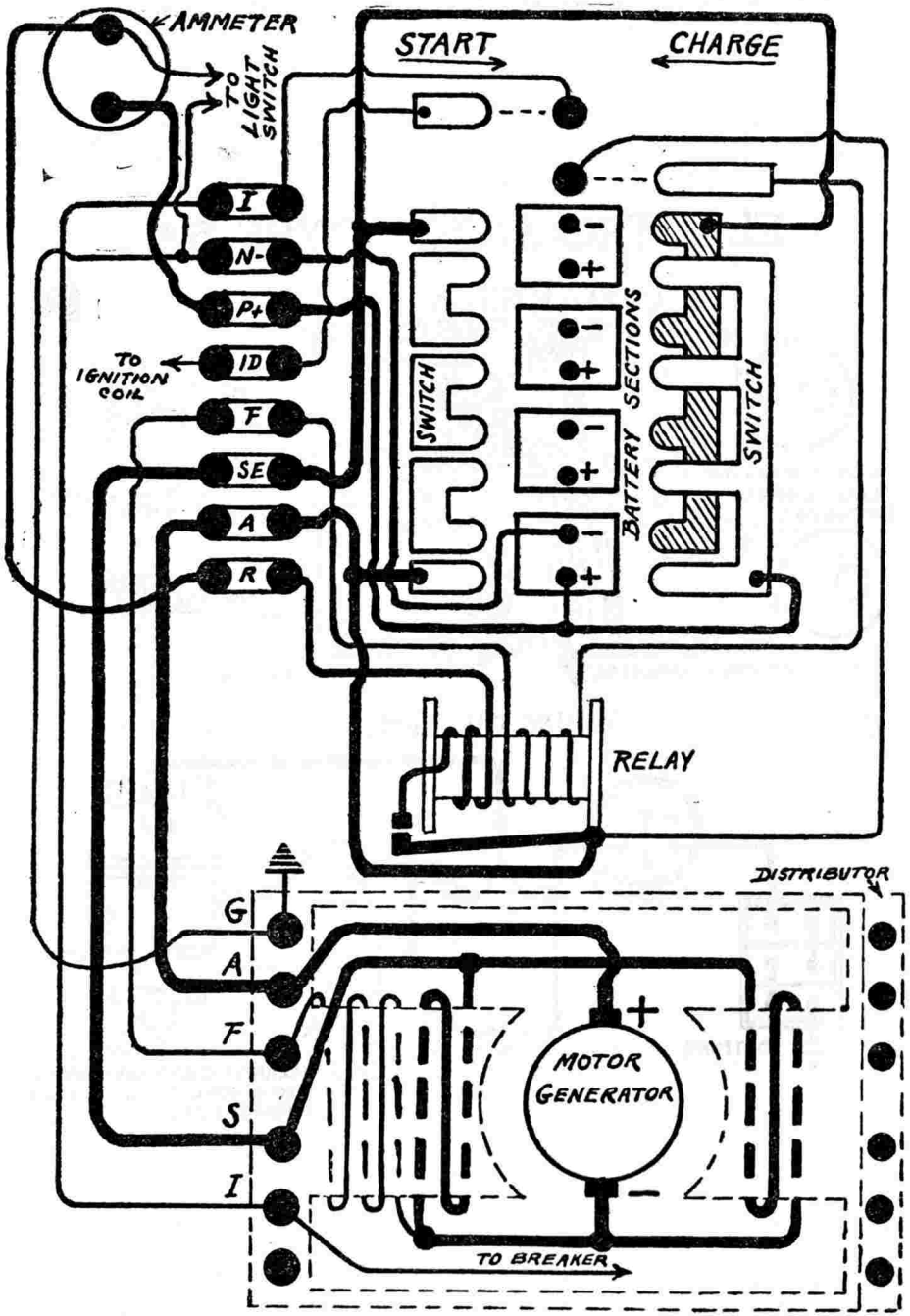
Diagram of types A8, BK and BL.

Longitudinal section and front view.



A Cam nut.
B Steel contact for high tension distributor.
C Platinum contact for make and break lever.
D High tension distributor cover.
E Nut for adjustable contact screw.
F Spring for make and break lever.
G Carbon contact for high tension distributor.
H Make and break lever.
I Low tension carbon brush.
K Adjustable platinum contact screw.
L Grease box for large toothed wheel.
M 5 mm nut.
N Cam.
O Cable joints.
Q Metal contact.
S Screw for spring for make and break lever.
V High tension distributor.

When ordering spare parts please state whether for type A8, BK or BL or else mention number stamped on base plate of magneto.



ELECTRO SYSTEM

ELECTRO
GENERATING AND STARTING SYSTEM

BATTERY.—Battery is 24 volt, 20 ampere-hour. The two-wire system is used. The battery is divided into four sections of three cells each. The starting switch connects the four sections in series for starting, and in parallel for charging. The switch, battery and relay are contained in the battery box, which has eight terminals, usually marked as shown.

STARTER-GENERATOR.—Starter and generator are combined into one unit, which is permanently connected to the crank shaft. The unit has six terminals, one of which is usually not used. When used, it serves only as a junction post. In some cases, the three terminals "A", "F" and "S" only are used. When the starting switch is in the "Start" position, the switch fingers shown on the left hand side (Plate 500J) make contact with the battery terminals, connecting the four sections in series. Current flows from the positive (+) battery terminal through the switch finger to the terminal "A", then to terminal "A" on the starter-generator, through the armature and the series field windings to terminal "S", then to terminal "SE" on the battery box and through the switch finger to the negative (—) battery terminal.

GENERATOR.—When the switch is in the "Charge" or "Run" position, the switch fingers shown on the right hand side make contact with the battery terminals, connecting the four sections in parallel. Current flows from the positive (+) generator brush, through terminal "A" on the starter-generator to terminal "A" on the battery box, then through a contact and switch finger (upper right hand corner) to the relay, through the fine winding of the relay to terminal "F", then to terminal "F" on the starter-generator and through the shunt field winding to the negative (—) brush. This completes the circuit through the shunt field and voltage winding of the relay. When the relay closes, the charging current flows from the positive (+) generator brush, through terminals "A" to the relay frame, thence across the contacts and through the heavy winding to terminal "R" on the battery box. From terminal "R" the current flows through the ammeter to terminal "P+" on the battery box and thence to the switch arm, whose fingers make contact with all the positive (+) battery contacts. The current leaves the negative (—) battery contacts through the fingers of the shaded switch arm, flows to terminal "SE", then to post "S" on the starter-generator and through the series field windings to the negative (—) generator brush, completing the charging circuit. No means of current or voltage regulation are provided. The current output increases with the engine speed, reaching a maximum of 30-35 amperes at high speed.

OILING.—Put 5 or 6 drops of light engine oil in the starter-generator oilers every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

RELAY.—Relay closes at 8-10 and opens at 6-8 miles per hour. Clean the contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with fine emery cloth.

ELECTROLOCK

DESCRIPTION:—The Electrolock is an ingnition switch mounted on the dash consisting of a lock cylinder in a steel case which is connected to the distributor housing terminal by an armored cable. The breaker lead from the coil is carried inside the cable which is fastened to the breaker terminal by a special design non-removable clip connection. This absolutely prevents tampering with the ignition circuit and prevents the car being started with the ignition turned off since the breaker is grounded through the Electrolock case and through the distributor attachment.

To unlock Electrolock, insert key in lock cylinder and turn ¼ turn to right. The lock cylinder will spring out closing the ignition switch. The key should then be removed since it is not necessary to lock the ignition. To turn off ignition, press lock cylinder in and make certain that it does not spring out again. This will turn off ignition, ground the breaker and lock the Electrolock itself to the car.

The Electrolock is manufactured in two types, the 5-A with one terminal on the side of the case, and the Type 5-B with three terminals on the side of the case.

TYPE 5-A

Connections:—The terminal on the side of the Electrolock case should be connected to the breaker terminal of the ignition coil. The feed for the coil is taken directly off the ammeter or from the relay terminal of the generator. The breaker circuit is completed through the armored cable from the Electrolock to the terminal on the distributor housing.

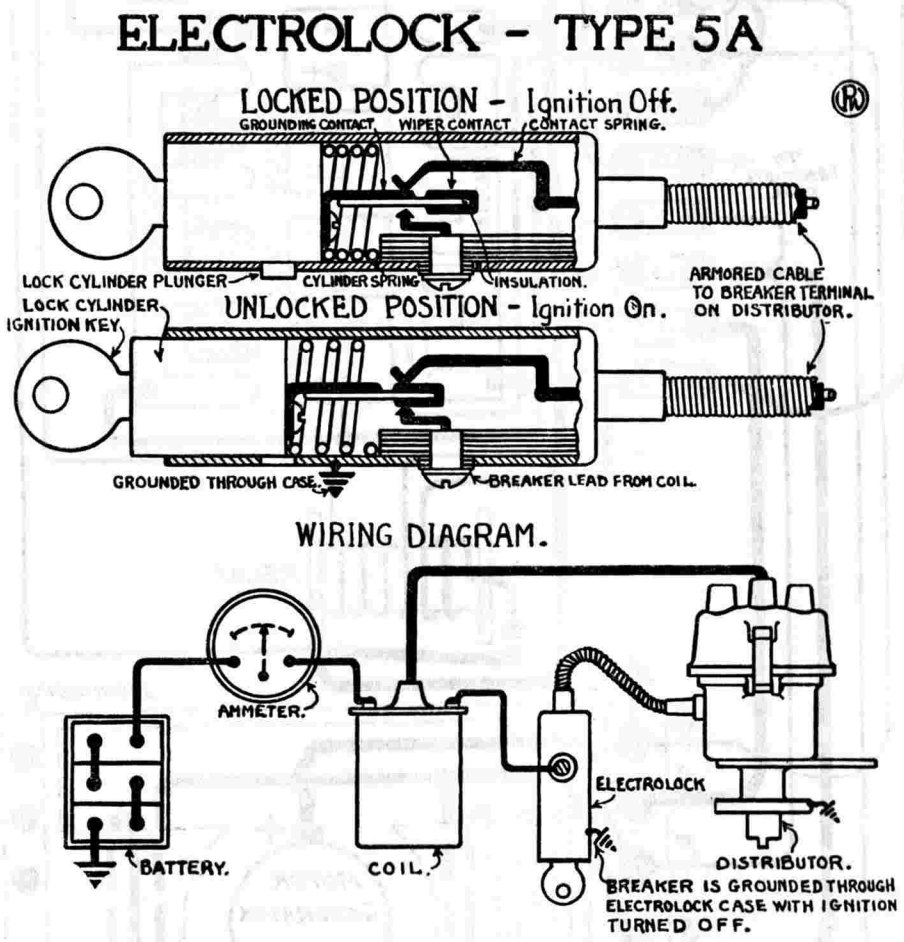
Servicing Distributor:—To remove distributor from car for bench tests or repairs, unlock Electrolock and remove from dash. Remove distributor from engine as directed on the car data sheet. Then remove entire distributor and Electrolock assembly from car.

Trouble Shooting on Car:—Disconnect wire from side of case. Insulate breaker contacts with a piece of cardboard or turn cam until contacts separate. Then make following tests with six volt lamp circuit and test points:

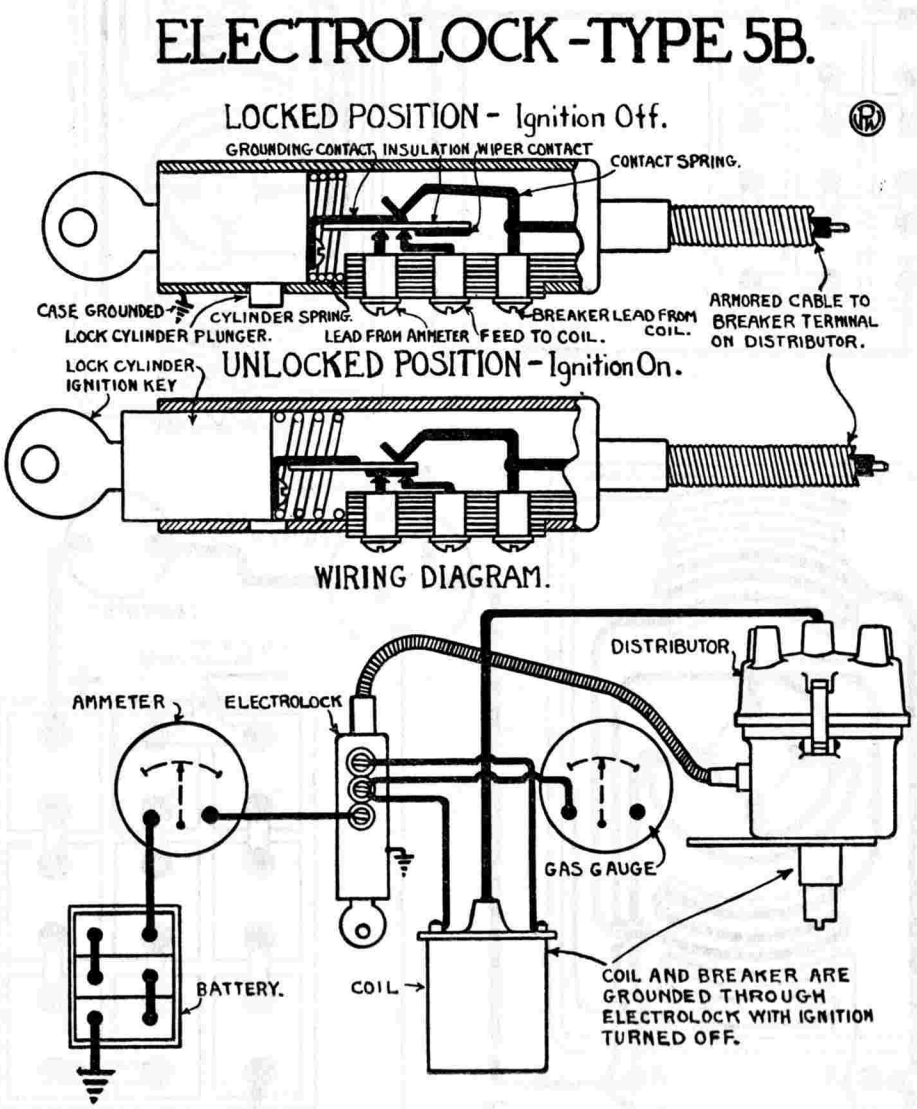
(1) Place one test point on breaker terminal inside distributor and place the other point on the terminal on the side of the Electrolock case. With Electrolock in the unlocked position, the lamp should burn. With Electrolock locked the lamp should not burn.

(2) Place one test point on the breaker terminal inside the distributor. Place the other point on the Electrolock case. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If the lamp burns there is a gound in the Electrolock or the condenser is shorted or grounded. Disconnect the condenser and repeat the test.

If these tests indicate the Electrolock is operating satisfactorily look for ignition trouble in coil, breaker, distributor or spark plugs. If tests indicate trouble in the Electrolock disassemble as directed in paragraph on "Servicing Electrolock."



ELECTROLOCK



TYPE 5-B

Connections:—The Type 5-B Electrolock has three connections on the side of the case. The ignition feed wire from the ammeter is connected to the terminal nearest the front or lock cylinder end of the case. The ignition coil lead and all accessories such as gasoline gauges or temperature indicators are connected to the middle terminal. The breaker lead from the coil is connected to the third terminal and the breaker circuit is completed through the armored cable to the terminal on the side of the distributor housing.

Servicing Distributor:—To remove distributor from car, unlock Electrolock, disconnect wires from side of case and remove Electrolock from mounting on dash. Then remove distributor from engine as directed on car data sheet. Lift out entire distributor and Electrolock assembly and remove to bench for distributor tests or repairs.

Trouble Shooting on Car:—Disconnect all wires on side of lock case and block open distributor contacts with a piece of cardboard or turn cam until contacts open. Then make following tests with six volt lamp circuit and test points:

(1) Place one test point on the primary terminal inside the distributor and place the second test point on the lock case. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn.

(2) Place one test point on the primary terminal inside the distributor and place the second test point on the No. 2 (or center) terminal of the switch. Unlock the switch, push the lock cylinder in half way and release it. The lamp should not light during this movement of the lock cylinder.

(3) Place one test point on the lock case and place the second test point on the No. 3 (or last) terminal. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If the lamp burns the Electrolock is grounded or the condenser is shorted or grounded. Disconnect condenser and repeat test.

If these tests indicate Electrolock is operating satisfactorily look for ignition trouble in the coil, breaker, distributor or spark plugs. If tests indicate trouble in the Electrolock, disassemble, examine and repair Electrolock as directed in the following paragraph.

SERVICING ELECTROLOCK:—Unlock Electrolock and remove from dash mounting. Disconnect all wires from case. Then take out small set screw on side of lock case and take out lock cylinder. Remove the coil spring directly behind the lock cylinder and pull out metal wedge holding bakelite terminal block in position. With terminal screws removed, the part of the bakelite piece in which the terminal screws are located can be pushed into the lock casing and the lock casing can then be slid back on the cable allowing the switch to be inspected. Any trouble in the switch due to broken parts can then be discovered. New parts for replacement can be obtained and the lock repaired.

If the lock cylinder does not work freely because of dirt in the lock case, the lock cylinder should be removed and cleaned off. Do not put oil or grease in the lock cylinder. If tumblers stick use graphite. In assembling Electrolock make certain that all terminals are insulated down to the screw heads to avoid possibility of short circuits.

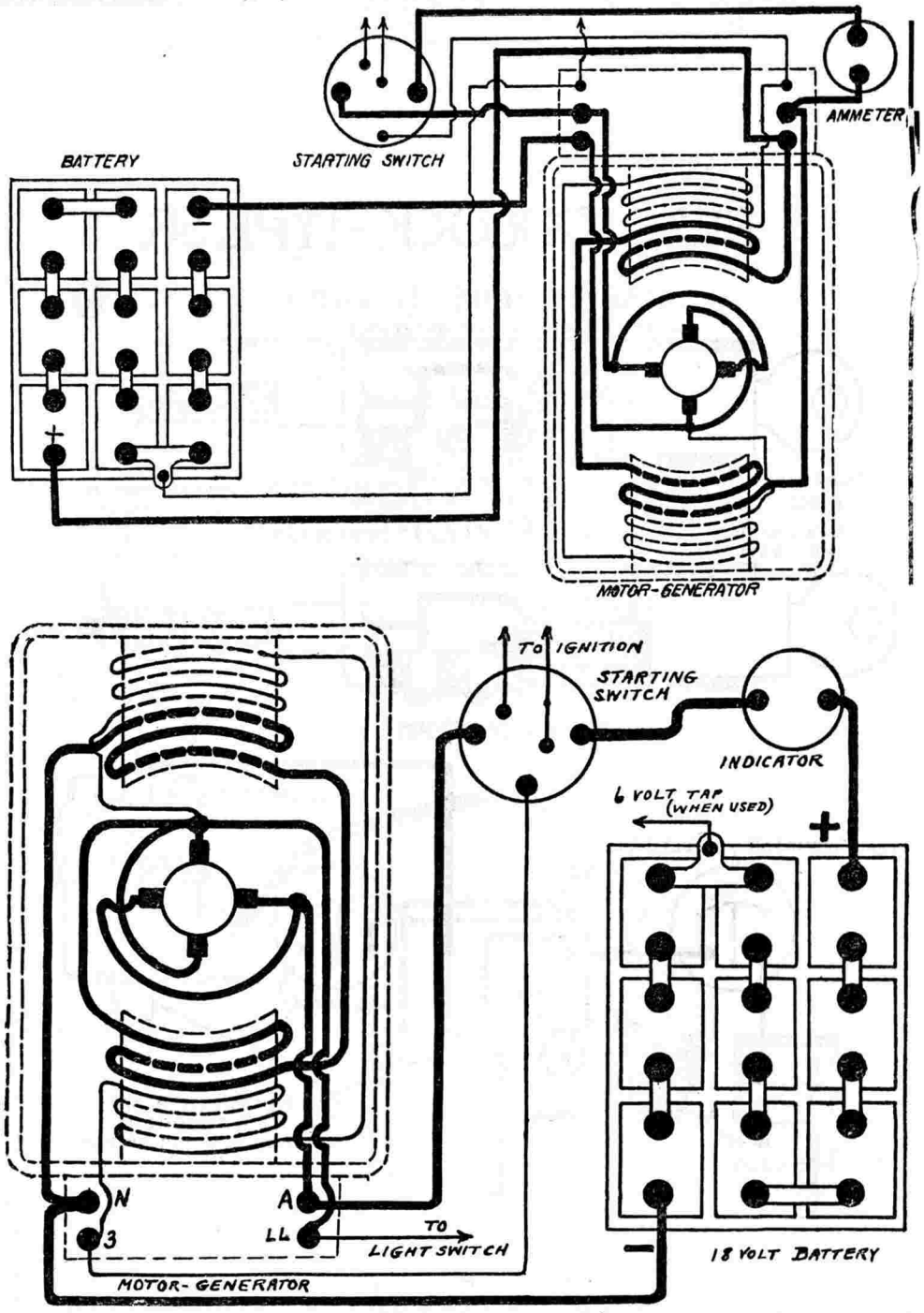
ENTZ

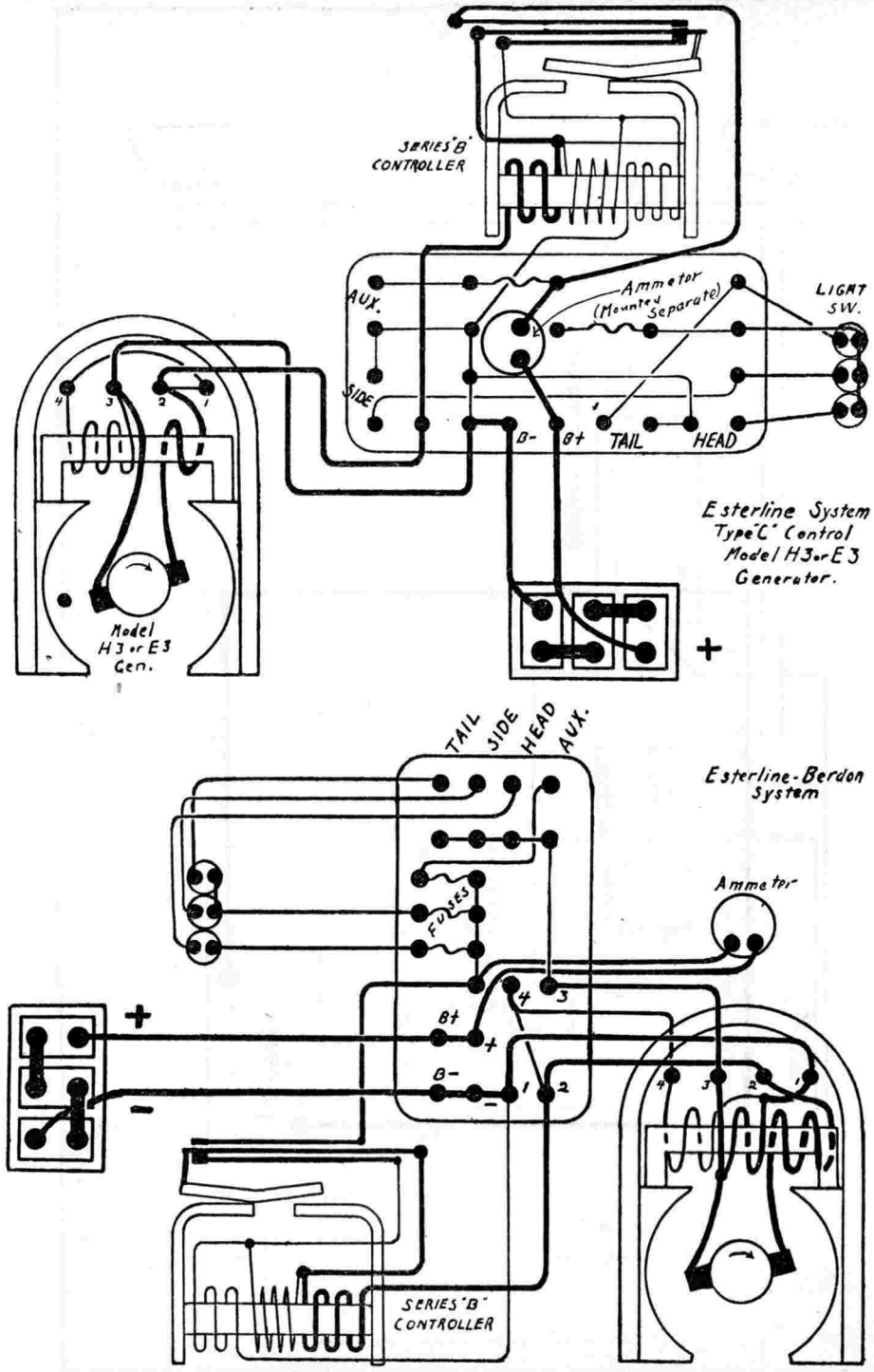
GENERATING AND STARTING SYSTEM

BATTERY.—Battery is 18 volt, 35-70 ampere-hour. The two-wire system is used.

STARTER-GENERATOR.—Two types of starter-generators are used, one with four terminals and one with either five or six terminals. Internal circuits of the four-terminal type are shown in Plate No. 500E-1. Internal circuits of the five or six-terminal type are shown in Plate No. 500E-2. The sixth terminal is a junction post only, having no connection with the motor-generator internally. The unit is permanently chain connected to the engine crankshaft. As there is no relay, the system possesses what is known as the non-stalling feature, that is, the battery is always connected to the motor-generator when the switch is in the "Start" or "On" position, so will turn the armature as a motor when the car is running under 6-8 miles per hour (high gear), helping to propel the car or starting the engine should same become stalled.

GENERATOR.—The unit operates as a generator at speeds above 6-8 miles per hour or 600 R.P..M. of the armature when the switch is in the "Start" position. When the switch handle is in the middle or "Neutral" position, the motor-generator is disconnected from the battery, but the ignition circuit remains closed. This position is used for long daylight drives when it is not advisable to continue charging a fully charged battery or in traffic when the car is being driven below 6-8 miles per hour and the non-stalling feature is not desired. Generator current regulation is by reverse series field. Normal maximum charging rate is 10 amperes, reached at 2400 R.P.M. of the armature or 25-30 miles per hour.





Esterline Generating and Lighting System

ESTERLINE

GENERATING AND LIGHTING SYSTEM

BATTERY.—Battery is 6 volt, 100-130 ampere-hour. The two-wire system is used.

GENERATOR.—Models H, EM and E-6. Generator is of the permanent field type, the magnetism being strengthened and controlled by field windings. Generator current regulation is by reverse series field. In the four-wire type (see Plate No. 500D) there are three field windings. In addition to the usual series and shunt coils, there is a second series coil which is in the charging circuit but not in the lamp circuit. When the lamps are turned on, the output automatically increases. There is no adjustment for varying the charging rate.

GENERATOR DATA

Model H

Amperes Charge Only	Amperes Charge and Lamps	R.P.M.
0	2.5	560
4	6.2	780
8	10.4	1250
10	12.4	1650
12	14.5	2200

Model EM., No. 365

Amperes Charge Only	Amperes Charge and Lamps	R.P.M.
0	2.0	375
2	4.0	500
4	6.4	700
6	8.8	1100
8	10.5	1700
9	11.5	2400

Model E-6, Kissel

Amperes Charge Only	Amperes Charge and Lamps	R.P.M.
0	1.0	340
4	5.5	550
8	9.7	820
12	14.0	1300
16	19.0	2400

Model EM, No. 414

Amperes Charge Only	Amperes Charge and Lamps	R.P.M.
0	2.4	500
2	5.0	650
4	7.5	875
6	10.5	1500
7	12.0	2200

OILING.—Put 4 or 5 drops of light engine oil in the generator bearing oilers every two weeks. If the car is drven more than 500 miles in two weeks, the oiling must be done every 500 miles.

RELAY.—Relay closes at 8-10 miles per hour, or from 340 to 560 R.P.M. of the armature, depending upon the model of the generator. Relay opens at 6-8 miles per hour. Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper Remove all grit. Adjust before again putting into service.

FUSES.—All fuses are 15 ampere.

GENEMOTOR SYSTEM

FOR FORD MODEL T

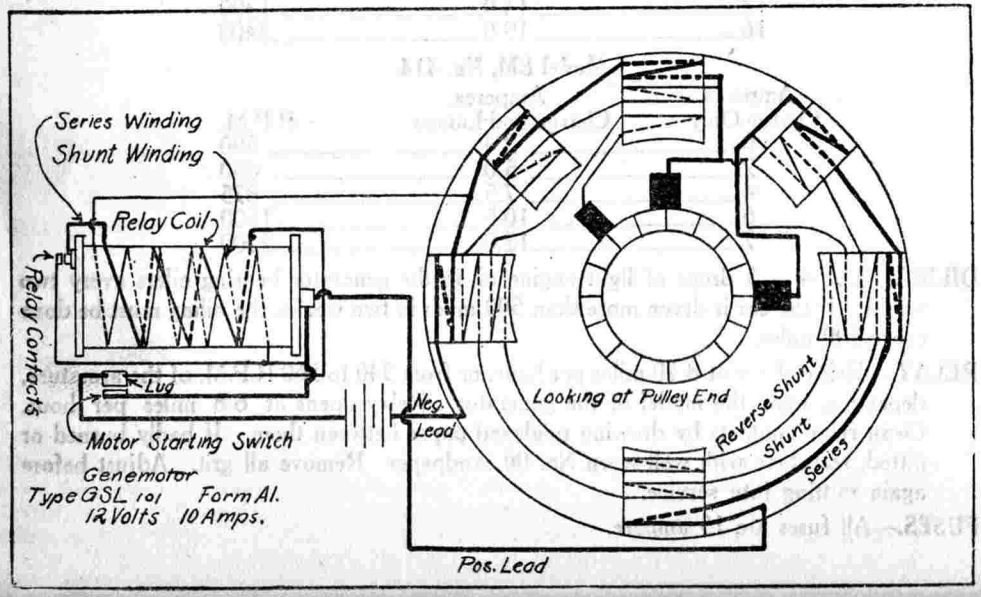
Battery.—Battery is 12 volts, 45 ampere-hour. The two wire system is used.

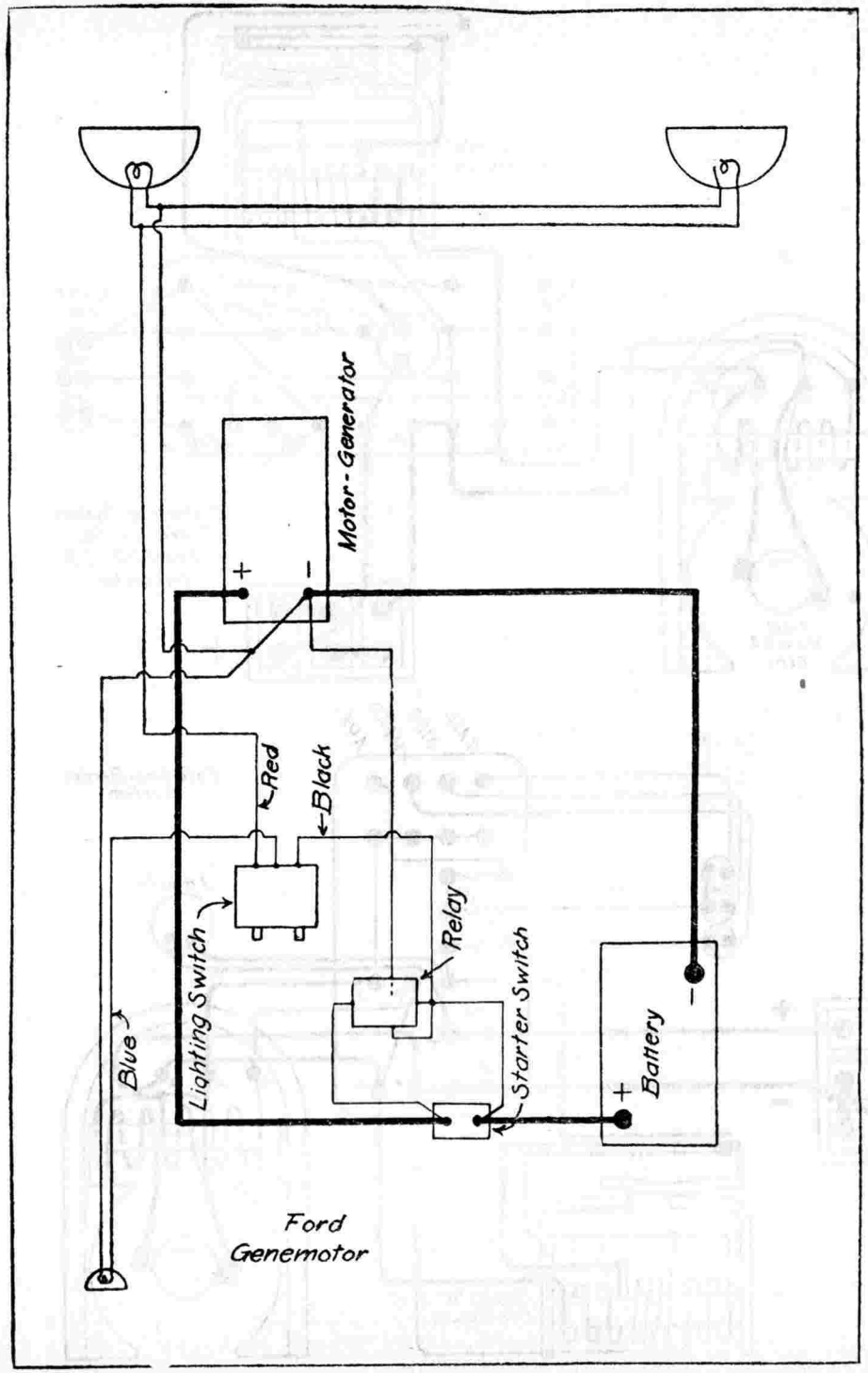
Starter.—Starter is connected to the engine by silent drive chain or by gear. It should deliver 45 pound-feet lock torque. It should crank engine at about 150 R. P. M. Cold engine, heavy oil, tight bearings or other obstructions, or damp, grounded or short circuited windings or commutator bars will cause low speed and excessive current during the cranking operation. Discharged battery, defective connections in starting circuit, defective switch contacts, dirty commutator or defective brushes will cause low speed and low current or failure of starter.

Generator.—Generator current regulation is by third brush system. Relay is mounted on the unit. Relay should close at 9-10 miles per hour. Clean contacts by drawing a piece of unglazed paper between them. If badly burned or pitted, resurface with a piece of well worn No. 00 sand paper, drawing a piece of unglazed paper between them, to remove all grit, before again putting into service. Maximum output of generator should not exceed 10 amperes.

Oiling.—Refill cup in front bearing with soft cup grease and turn down every two weeks. At the same time grease gear teeth through hole in gear guard. Also put a few drops of light engine oil in each of the motor-generator oilers every two weeks. On machines having chain drive, grease chain every two weeks. If car is driven more than 500 miles in two weeks the oiling must be done every 500 miles.

Lamps.—Head lamps are 12-16 volts, 16 cp., vacuum, or 12-16 volts, 24 cp., gas-filled. (The gas-filled lamps are not advisable ordinarily as they will cause excessive glare.) Tail lamp is 12-16 volts, 3 cp.

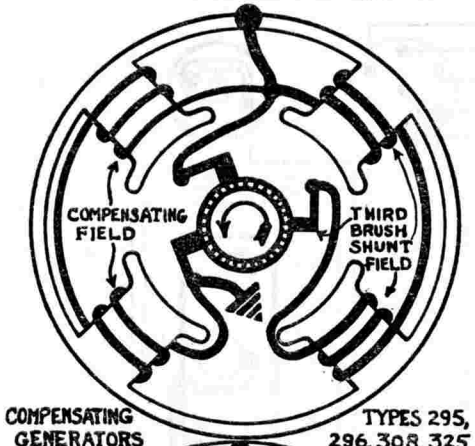




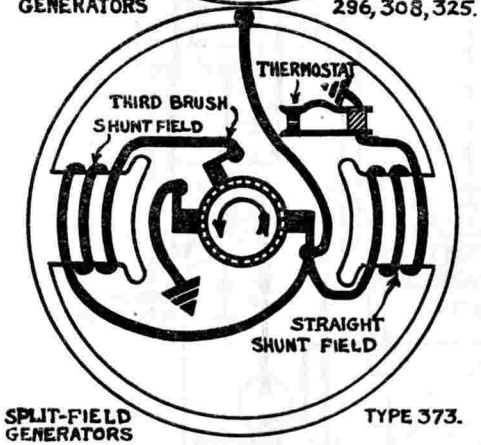
SPECIAL GENERATORS

DELCO COMPENSATING GENERATORS

Description:—These are four pole generators with two main brushes and regular third brush for current regulation. The third brush shunt field connected between the third brush and one main brush is wound on two field poles either adjacent or opposite as shown in the illustrations. A straight shunt field called the compensating or stabilizing field connected between the two main brushes is wound on the other two poles. The two fields work together. One main brush is grounded and the lead to the relay is taken from the other insulated main brush.



COMPENSATING GENERATORS — TYPES 295, 296, 308, 325.



SPLIT-FIELD GENERATORS — TYPE 373.

Operation:—The third brush shunt field builds up until the peak output is reached. Above this point the voltage at the third brush drops off and the strength of the third brush shunt field decreases. The compensating field, however, continues to increase in strength which tends to maintain the field at normal strength regardless of the armature speed. This compensating or stabilizing action results in a very even charging rate at all speeds above the peak, and the falling off of the charging rate which is characteristic of ordinary third brush generators does not occur.

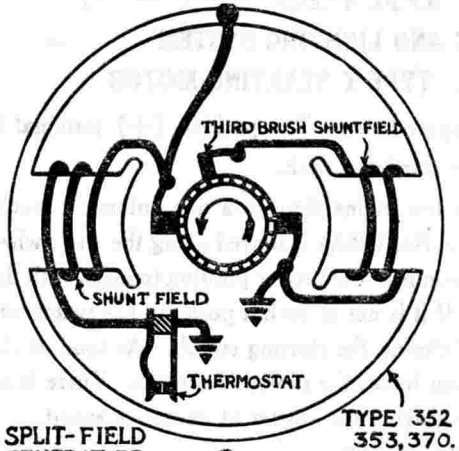
Performance and Adjustment:—See specific car data sheets on which these generators are used for performance data, adjustment of charging rate and details of mounting. Compensating generators are used on the following cars:

Generator Model	Car	Model	Year
295	Oldsmobile	30	1925
296	Moon	A	1925
308	Moon	A	1925-26-27
325	Diana	8	1925-26-27
325	Davis	92, 93	1926

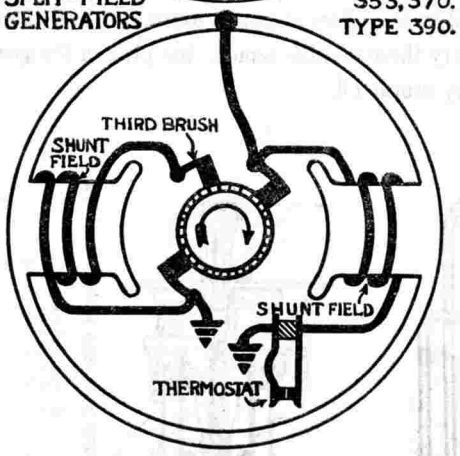
Trouble Shooting:—If the charging rate is below normal and falls off at speeds above 25 M.P.H. test the stabilizing field for shorted or grounded coils, open circuits, or reversed field coil. If the charging rate is below normal but continues to increase at speeds above 25 M.P.H., test the third brush field for shorted or grounded coils, open circuit or reversed field coil. Check field connections and see that they are correct as shown in the illustrations. Test polarity of field coils around the frame with the generator terminal of the cutout relay connected to a battery but with the grounded main brush off the commutator. They should test alternately North and South around the frame. All other tests may be made exactly as for ordinary third brush generators.

DELCO-REMY SPLIT-FIELD GENERATORS

Description:—These are two-pole generators with two main brushes and third brush for current regulation. The third brush shunt field connected between the third brush and one main brush is wound on one field pole. A straight shunt field is wound on the other field pole. One end of this field is connected to the insulated main brush and the other end is grounded through a thermostat—the circuit being completed to the grounded main brush through the frame. One main brush is grounded and the relay cutout lead is taken from the other insulated main brush. The two fields work together and are wound so that the two poles are North and South.



SPLIT-FIELD GENERATORS — TYPE 352, 353, 370. TYPE 390.



Operation:—The third brush shunt field builds up until the peak output is reached. Above this point the voltage at the third brush drops off and the strength of the third brush field decreases. At low speeds when the generator is cold, the straight shunt field adds to the strength of the field. When the generator temperature reaches 175 degrees F. the thermostat in the straight shunt field circuit opens. The thermostat has no resistance coil and acts as a switch to make this inoperative at temperatures above 175 degrees. Above this point the generator operates as a third brush machine of the consequent pole type with the one third brush field coil supplying all the field strength. This provides a higher charging rate at low speeds and for short runs, and automatically cuts down the charging rate on long tours.

Generator Model	Car	Model	Year	
352	Oldsmobile	E-30	1927	First 12000
353	Nash	Spec. 6	1927	
370	Cadillac	314	1927	
370	La Salle	303	1927	First 12000
373	Nash	Advan. 6	1926-27	

Performance and Adjustment:—See specific car data sheets on which these generators are used for performance data, adjustment of charging rate and mounting details. Split-field generators are used on the following cars:

Trouble Shooting:—If the charging rate is below normal and falls off at speeds above 25 M.P.H., test the straight shunt field for shorts or grounds, open circuits or defective thermostat contacts. If the charging rate is below normal and drops to '0' after a short time, test the third brush shunt field for shorts or grounds, open circuits, or defective third brush. If the charging rate is normal but does not drop off after continued operation test for defective thermostat. Do not attempt to repair thermostat. If tests prove thermostat to be defective, remove and replace unit. All other tests may be made exactly as for ordinary third brush generators.

GRAY & DAVIS

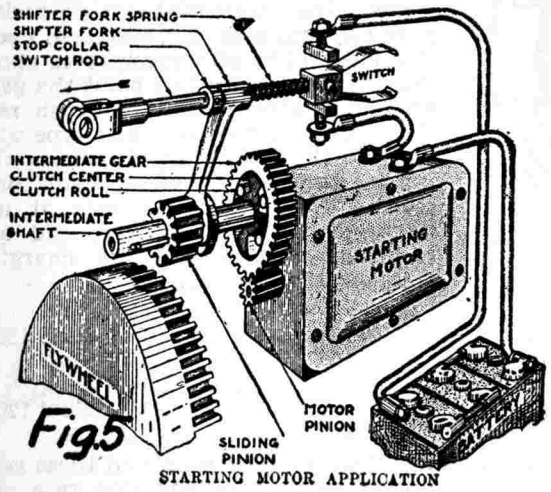
GENERATING, STARTING AND LIGHTING SYSTEM

TYPES T AND S GENERATORS. TYPE Y STARTING MOTOR

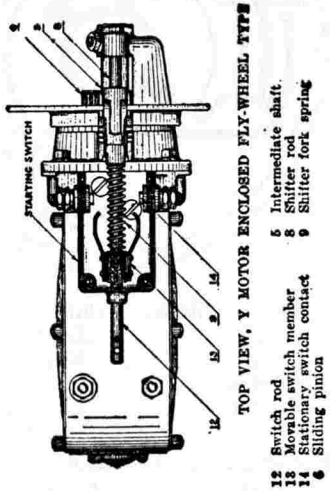
BATTERY.—Battery is 6 volt, 80-120 ampere-hour. The positive (+) terminal is grounded at the starting motor or at the starting switch.

STARTER.—Type Y. Starter is connected to the engine through a non-automatic mechical pinion shift. The sliding pinion (Plate No. 198A) is moved along the shaft when the starting pedal is depressed. If the pinion is in the proper position to mesh with the flywheel gear, it is meshed immediately. If it is not in such a position, the switch rod is moved on, compressing the spring and closing the starting switch. As soon as the motor starts to turn, the compressing spring forces the pinion into mesh. There is an overrunning clutch to prevent the engine driving the starter at excessive speed.

OILING.—Put 5 or 6 drops of light engine oil in the oilers at commutator end and intermediate shaft bearings every month. Every three months remove the plug in the gear case and inject one tablespoonful of heavy motor oil.



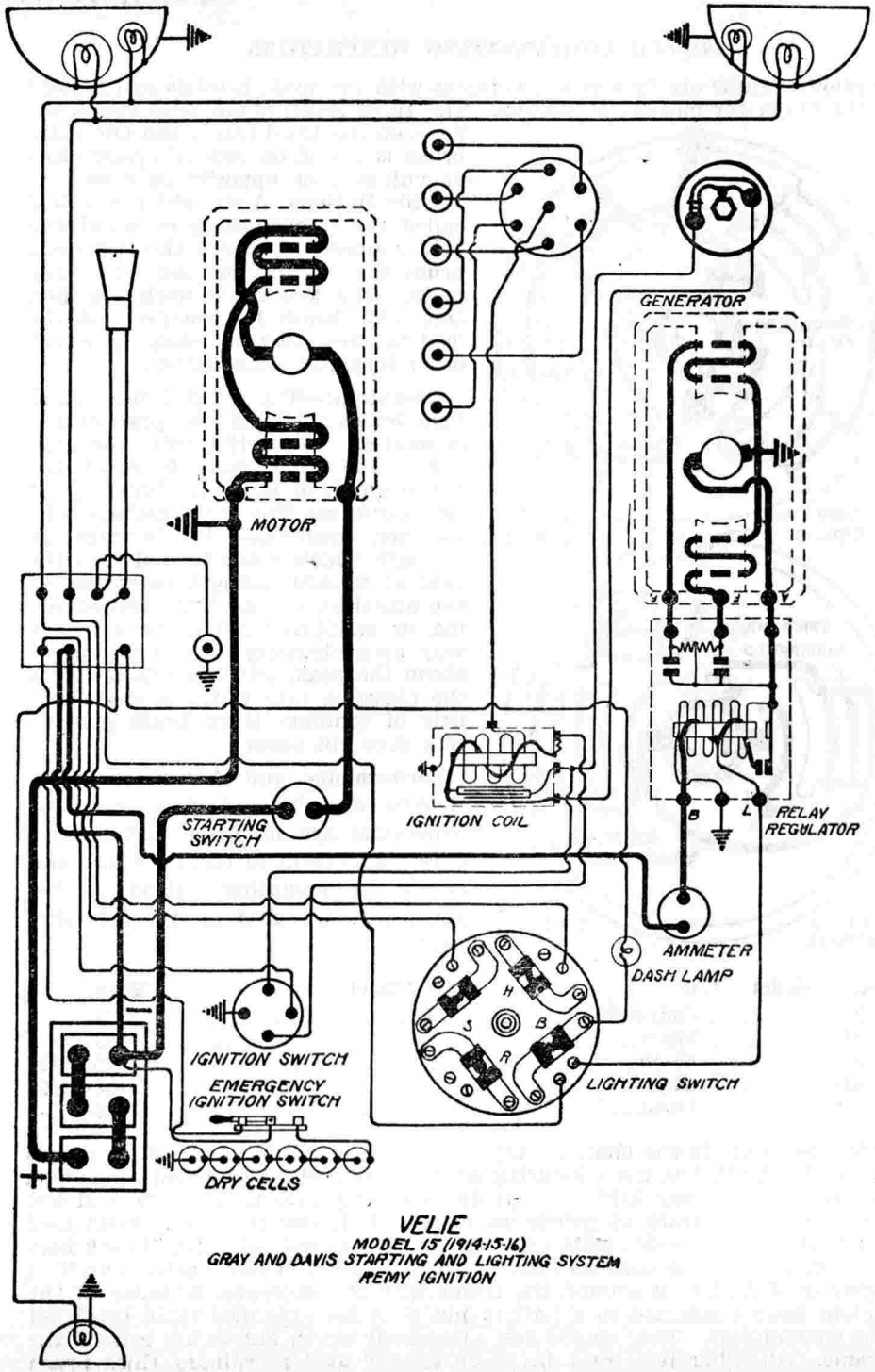
STARTING MOTOR APPLICATION

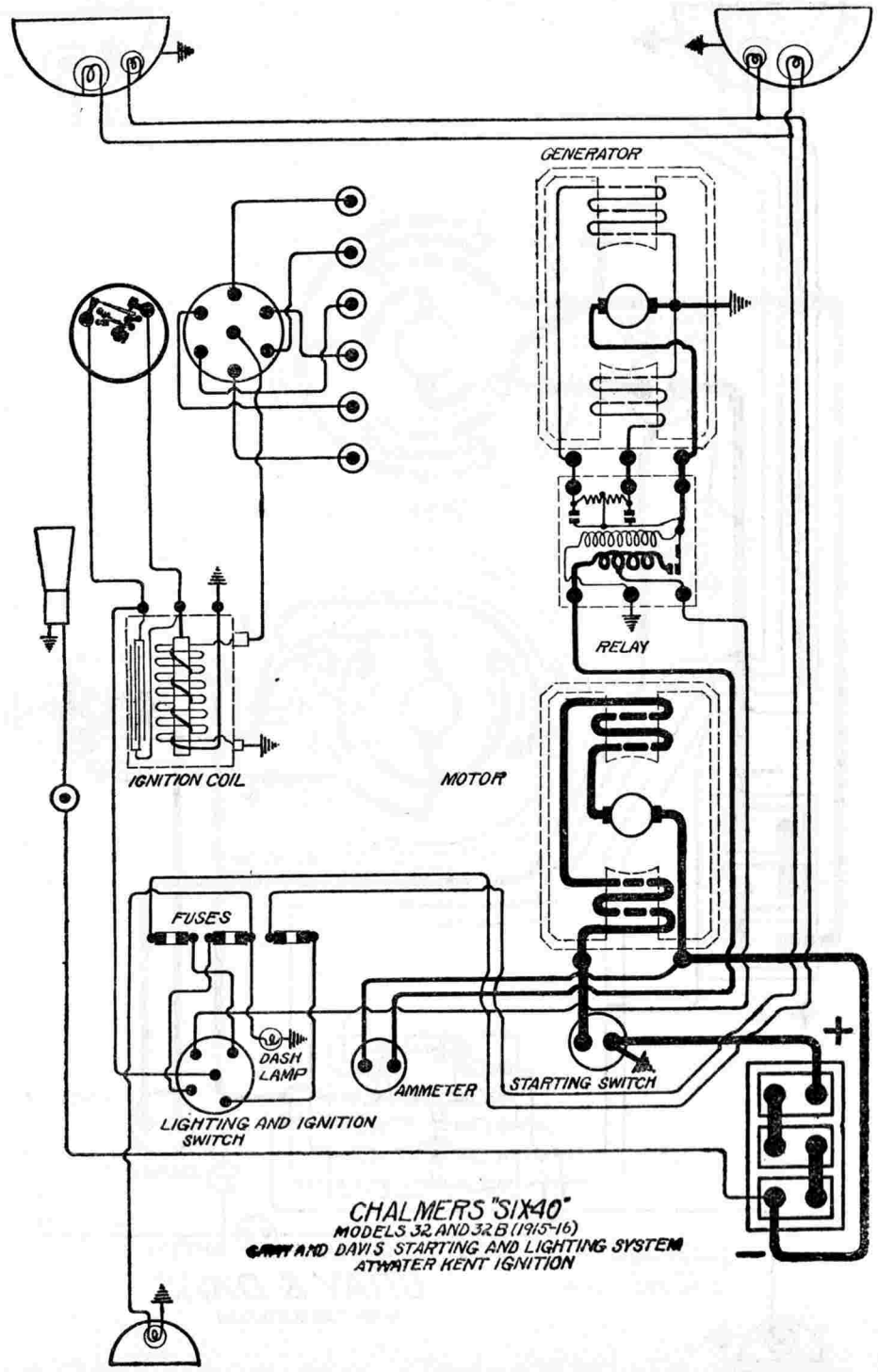


TOP VIEW, Y MOTOR ENCLOSED FLY-WHEEL TYPE

12 Switch rod
13 Movable switch member
14 Stationary switch contact
6 Sliding pinion
5 Intermediate shaft.
8 Shifter rod
9 Shifter fork spring

Gray & Davis Starting and Lighting System, as Applied to the Velie, Model 15





Gray & Davis Starting and Lighting System as applied to Chalmers 6-40.

GRAY & DAVIS

GENERATING, STARTING AND LIGHTING SYSTEM

TYPES T AND S GENERATORS. TYPE Y STARTING MOTOR

Continued from preceding page.

GENERATOR.—Types T and S. Generator output regulation is by vibrator-regulator. The Type T Generator is rated at 10 amperes, 6.5 volts, 1000 R.P.M. The Type S Generator is rated at 10 amperes, 6.5 volts, 650 R.P.M. Maximum charging rate is reached at 10 miles per hour. Charging rate varies slightly with condition of the battery, being highest when battery is discharged and decreasing as battery charges.

OILING.—Put 5 or 6 drops of light engine oil in each of the generator bearing oilers every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must done every 500 miles.

RELAY-REGULATOR.—Relay and regulator are combined to form a single unit. Relay closes at 8 miles per hour and opens at 6 miles per hour. Terminal "L", the terminal on the relay-regulator to which the lights are connected, is a tap taken off the series winding of the relay-regulator, some distance from the end, and conducts current to lamps and horn only. When the lamps are turned on, the frequency at which regulator armature (moving member) operates is reduced, increasing the output in proportion to the lamp load. Adjust regulator to limit the maximum current output to 10 amperes at speeds above 10 miles per hour. To adjust contacts, hold one set apart and adjust other set until the desired output is obtained. Then hold the first set apart and adjust the other set until the desired output is obtained. Then allow both sets to operate together. Increasing spring tension will increase the output. Decreasing spring tension will decrease the output.

LAMPS.—Head lamps are 6-8 volt, 16 cp. Side lamps are 6-8 volt, 4 cp. Dash and tail lamps are each 6-8 volt, 2 cp.

GRAY & DAVIS

GENERATING, STARTING AND LIGHTING SYSTEM (1913-14)

WITH CONSTANT-SPEED GENERATOR

BATTERY.—Battery is 6 volt, 85-130 ampere-hour. The positive (+) terminal is grounded, or the two-wire system is used.

STARTER.—Types H-1, H-2, and K. Starting motor is connected to the engine through a chain and overrunning clutch or a pinion shifted by the operator.

Starter Data. No Load

Type	Volts	Amperes	R.P.M.
H-1	6	150	1500
H-2	6	150	2600
K	6	100	3600

OILING.—Put 4 or 5 drops of light engine oil in each of the starter oilers every week. With the flywheel type, oil the sliding parts and bearing every week. If the car is driven more than 250 miles in two weeks, the oiling must be done every 250 miles. Inject soft cup or ball-bearing grease in the motor bearings every six months, and in the gear reduction case when used.

GENERATOR.—Types G-1 and E. Internal circuits are shown in Plate No. 500A. Output regulation is by mechanical speed control. Generator is chain driven, the speed ratio being such that the governor shaft revolves at 1000 R.P.M. for Type G-1, and 700 for Type E, when the engine is running at a speed equivalent to 10 miles per hour. The normal maximum outputs with low battery are as follows:

Generator Data

Type	Volts	Amperes	R.P.M.	M.P.H.
G-1	6.5	9	1000	10
E	6.5	10	700	10

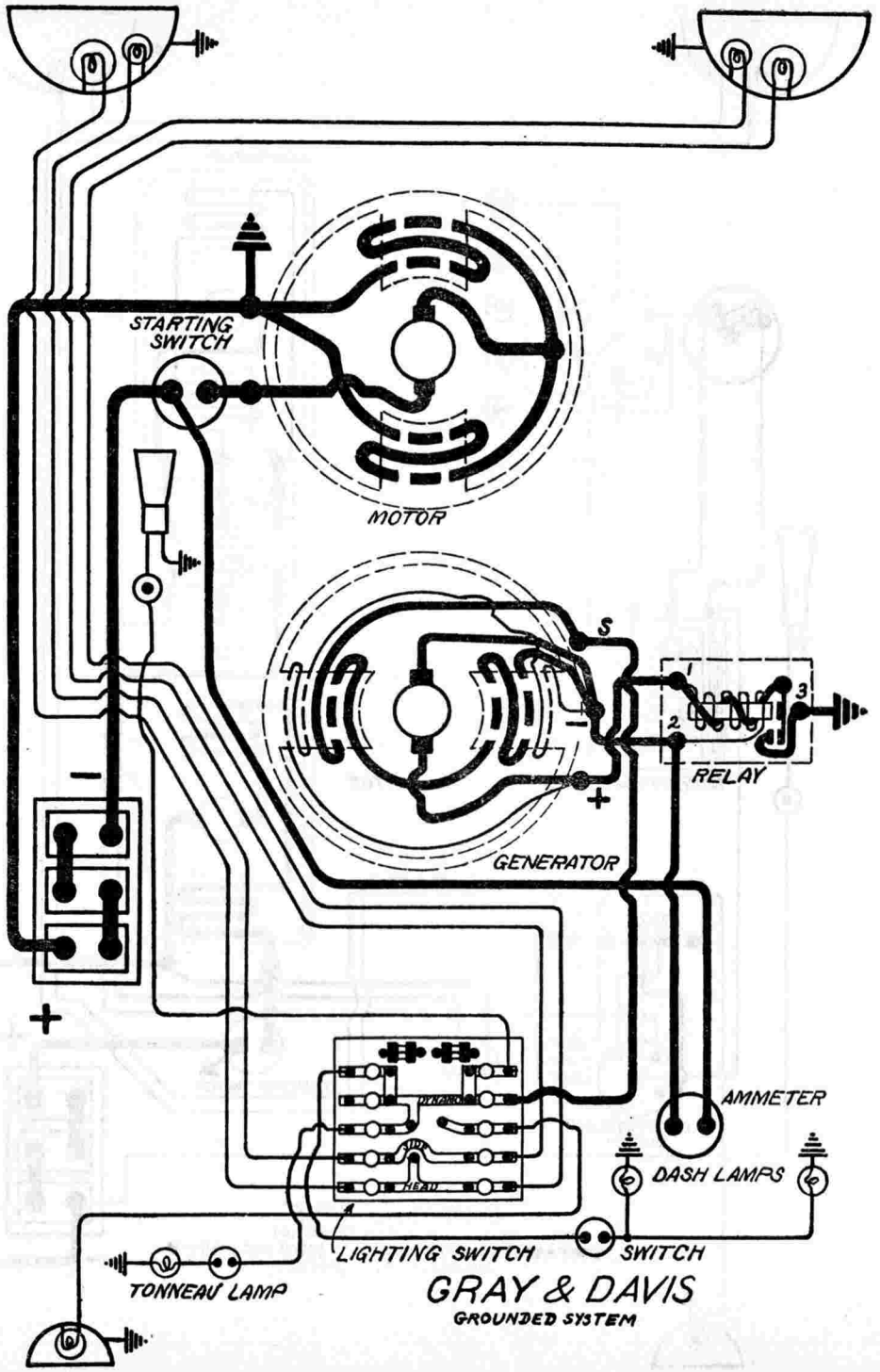
Charging rate decreases as battery becomes charged. The governor is of the shoe-and-shell type. The governor is adjustable by means of a screw, accessible through openings in the shoes and shell. These openings must first be brought into alignment with each other. A narrow screw driver may then be inserted. Turn the adjusting screw to the right to increase the output of the generator and to the left to decrease the output. The generator operates as a simple shunt wound machine, except when supplying current to the lights, when the series winding assists the shunt winding, strengthening the magnetism and increasing the output. Ammeter indications, with the lamps "on" and "off" at speeds above 12 miles per hour, are as follows:

Generator Data.—Ammeter Reading

Type	Lamps On	Lamps Off
G-1	0.5-1.5	3- 9
E	1.0-2.0	4-10

OILING.—Types G-1 and E. Put 5 or 6 drops of light engine oil in the drive end bearing and middle bearing of the generator every two weeks. Inject ball bearing grease between the races of the commutator end bearing. Put 2 or 3 drops of oil on the eight governor joints. If the car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

Continued on next page.



GRAY & DAVIS

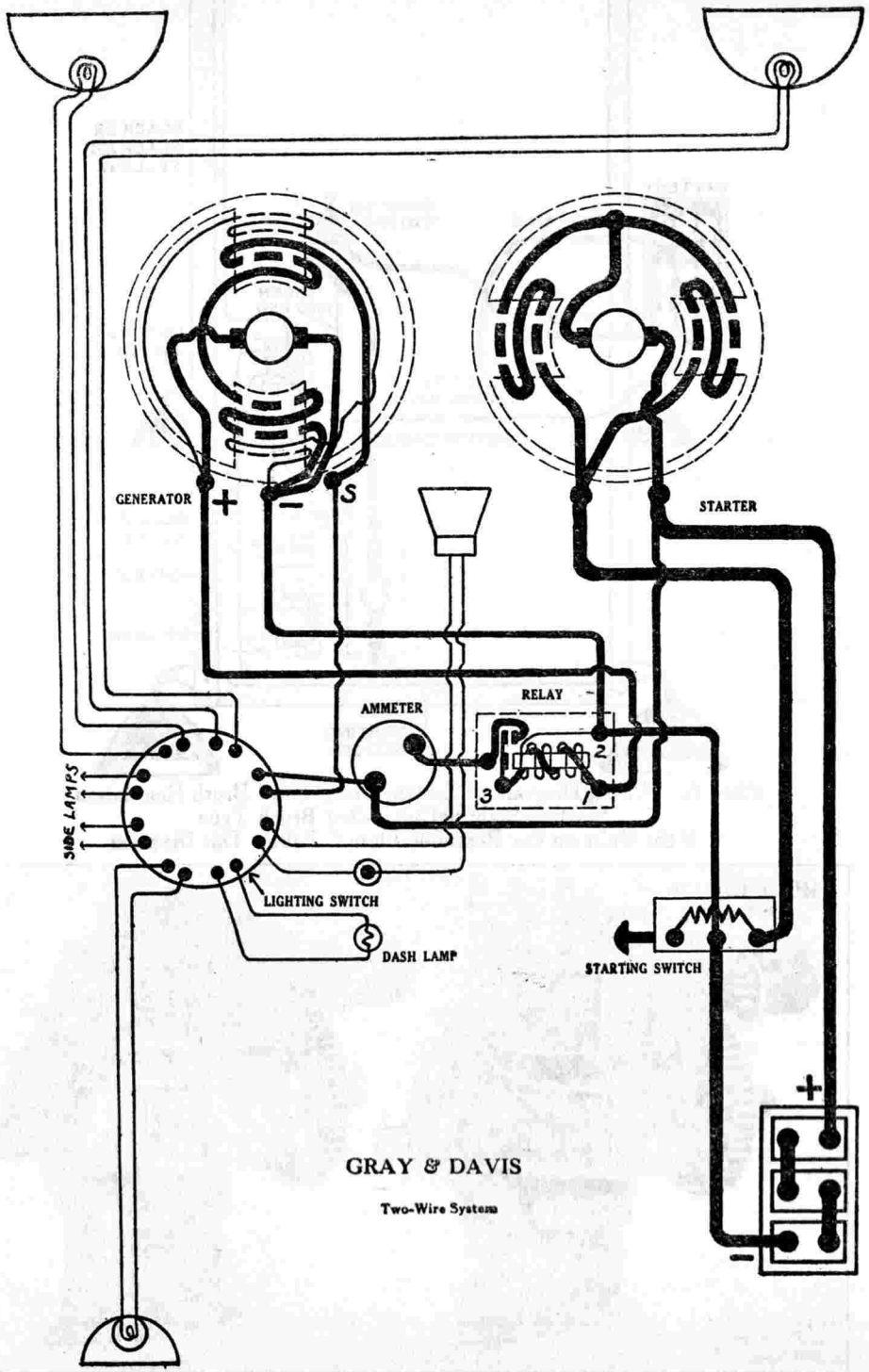
GENERATING, STARTING AND LIGHTING SYSTEM WITH CONSTANT-SPEED GENERATOR

GENERATOR.—Type C-1. Internal circuits are shown in Plate No 500B, except that the terminals are arranged "—", "S", "+" from left to right, looking at the commutator end. Generator is chain driven, the speed ratio being such that the governor shaft revolves at 1250 R.P.M. when the engine is running at a speed equivalent to 10 miles per hour. The maximum charging rate with a low battery is 8 amperes, reached at 1250 R.P.M. of the armature or 10 miles per hour. Charging rate decreases as battery becomes charged. The governor is of the disc type, one of the frictional surfaces being faced with asbestos fabric. To adjust the governor, remove the cover and loosen the set screw (No. 4, Plate No. 500B-1) one whole turn. Then insert two screw drivers, one on each side of the shaft, just back of the block (Plate No. 500B-2) and compress the spring. Tighten the set screw. Moving the block up 1/16 inch will increase the output about 2 amperes. The generator operates as a simple shunt-wound machine, except when supplying current for the lamps, when the series winding assists the shunt winding, strengthening the magnetism and increasing the output. Ammeter should indicate 3-8 amperes when running above 12 miles per hour with lamps "Off" and .5 to 1.5 amperes with lamps "On."

OILING.—Type C-1. The three shaft bearings of the generator must be lubricated with 5 or 6 drops of light engine oil or with soft ball-bearing grease every two weeks. If grease is used, the grease-gun spout must be the exact size to fit the oil holes. Put 4 or 5 drops of light engine oil in the governor bearing oiler (No. 2, Plate No. 500B-1). If the car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

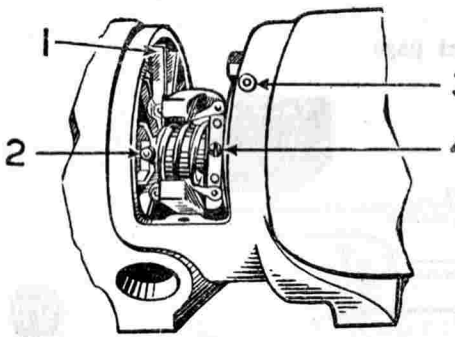
RELAY.—Relay closes at 10 miles per hour and opens at 8 miles per hour. Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface wth well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

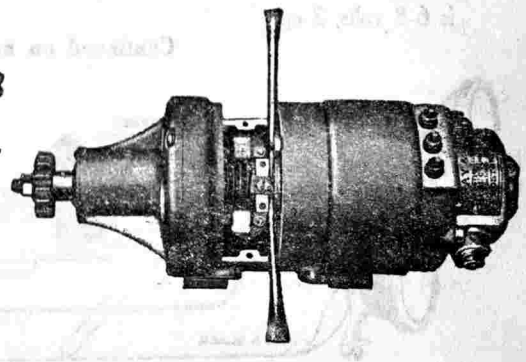
NOTE.—If the governor mechanism is worn out, the generator may be easily reconstructed to give reverse series field current regulation.



GRAY & DAVIS

Two-Wire System





Gray and Davis

For Ford Cars

Two Unit, Single Wire, Starting and Lighting System

Battery.—The battery is 6 volt, 70 ampere-hour. The positive (+) terminal is grounded.

Starter.—The starting motor, located above the generator, is connected to the engine through a Bendix drive, engaging a gear on the generator drive shaft. Cold engine, heavy oil, tight bearings or other obstructions or damp, grounded or short circuited motor windings will cause high current and low speed during the cranking operation.

Generator.—Generator current regulation is by third brush system or vibrating type regulator. Relay should close at 7-10 miles per hour. Charging current should be 1-3 amperes at closing and the discharge current ½-2 amperes at opening of relay contacts. There is a screw to adjust relay. The charging current should be 8-12 amperes at 12-14 miles per hour on cars using vibrating regulator and 12-15 amperes at 13-18 miles per hour, reducing to 10 amperes at high speed, on cars having third brush regulation. Clean relay and regulator contacts by drawing a piece of unglazed paper between them. If badly burned or pitted, resurface them with a piece of well worn No. 00 sand paper, drawing a piece of unglazed paper between them, to remove all grit, and adjust, before again putting into service. When possible, regulator should be adjusted with a fully charged battery in circuit. Regulator and relay are adjusted by turning the knurled screw provided.

Oiling.—Put several drops of light engine oil in each of the motor and generator oil cups every two weeks. At the same time, lubricate the chain well with light engine oil, wiping the excess oil from the surface, after time has been allowed for it to penetrate to the inner bearings, to prevent the collection of dirt. If car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

Lamps.—Head lamps are 6-8 volts, 17 cp. Side lamps are 6-8 volts, 5 cp. Tail lamp is 6-8 volts, 2 cp.

Continued on next page.

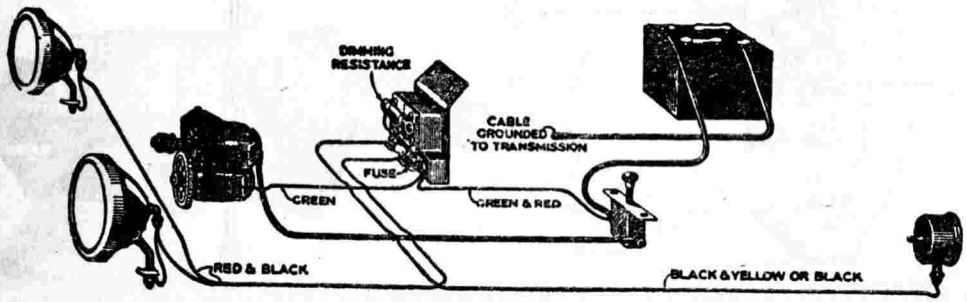


PLATE D
Pictorial Wiring Diagram

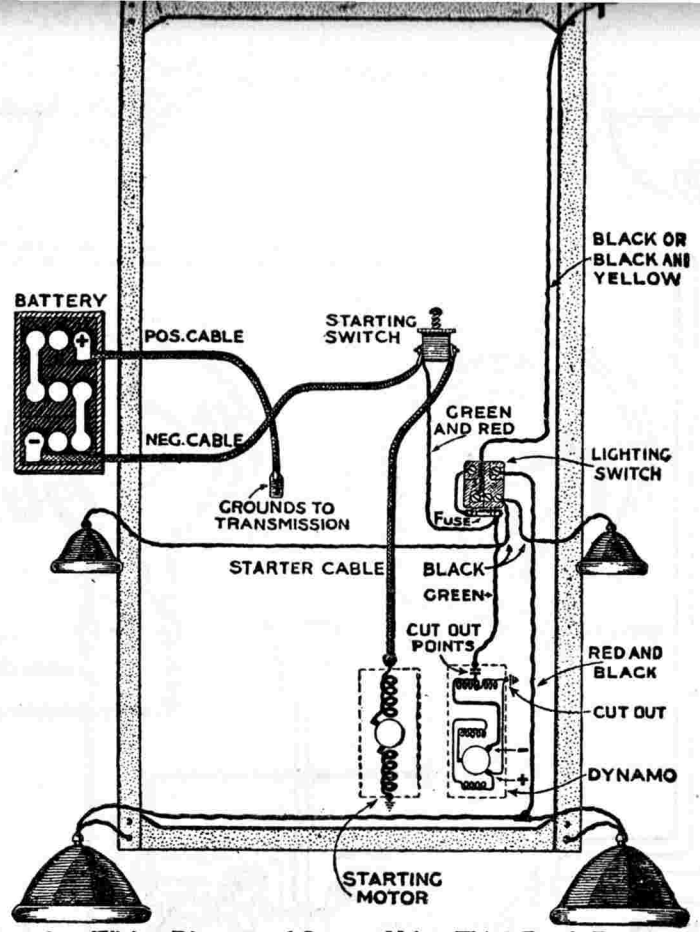


Plate A. Wiring Diagram of System Using Third Brush Regulation
Starting-Lighting Units—3rd Brush Type
If the Units on Car Resemble Plate C Follow This Diagram

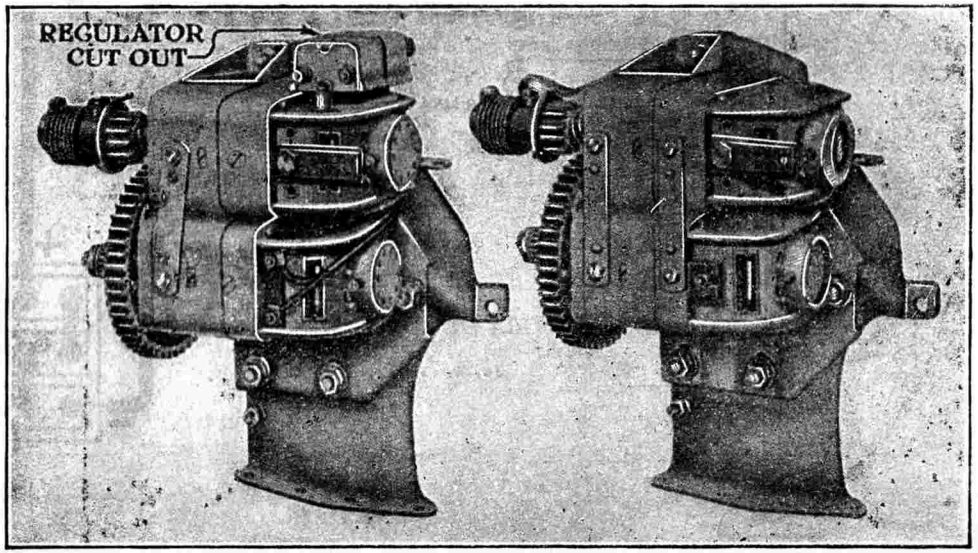


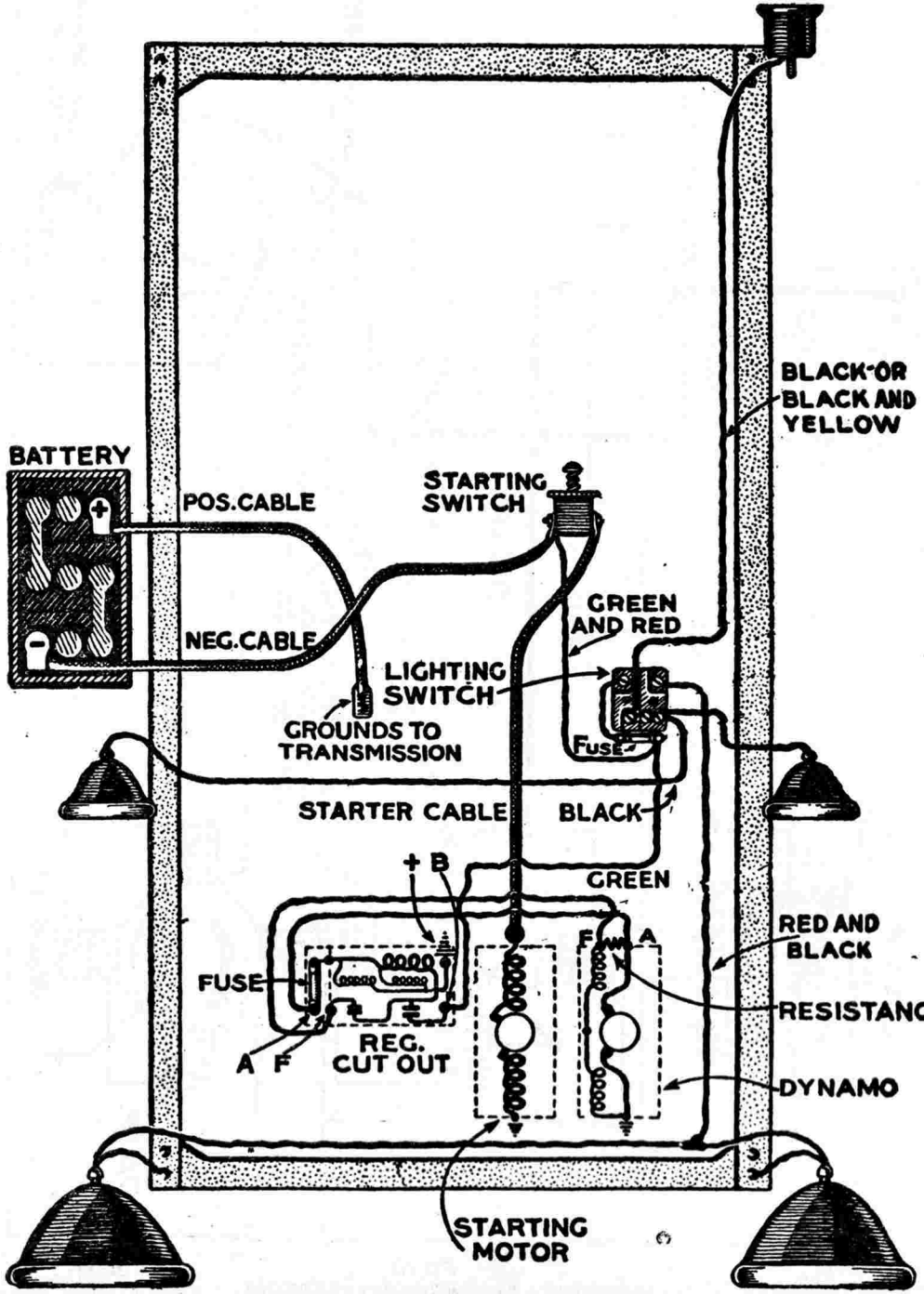
Plate B Plate C
Starting-Lighting Units—Regulator Type

GRAY & DAVIS

FOR FORD CARS

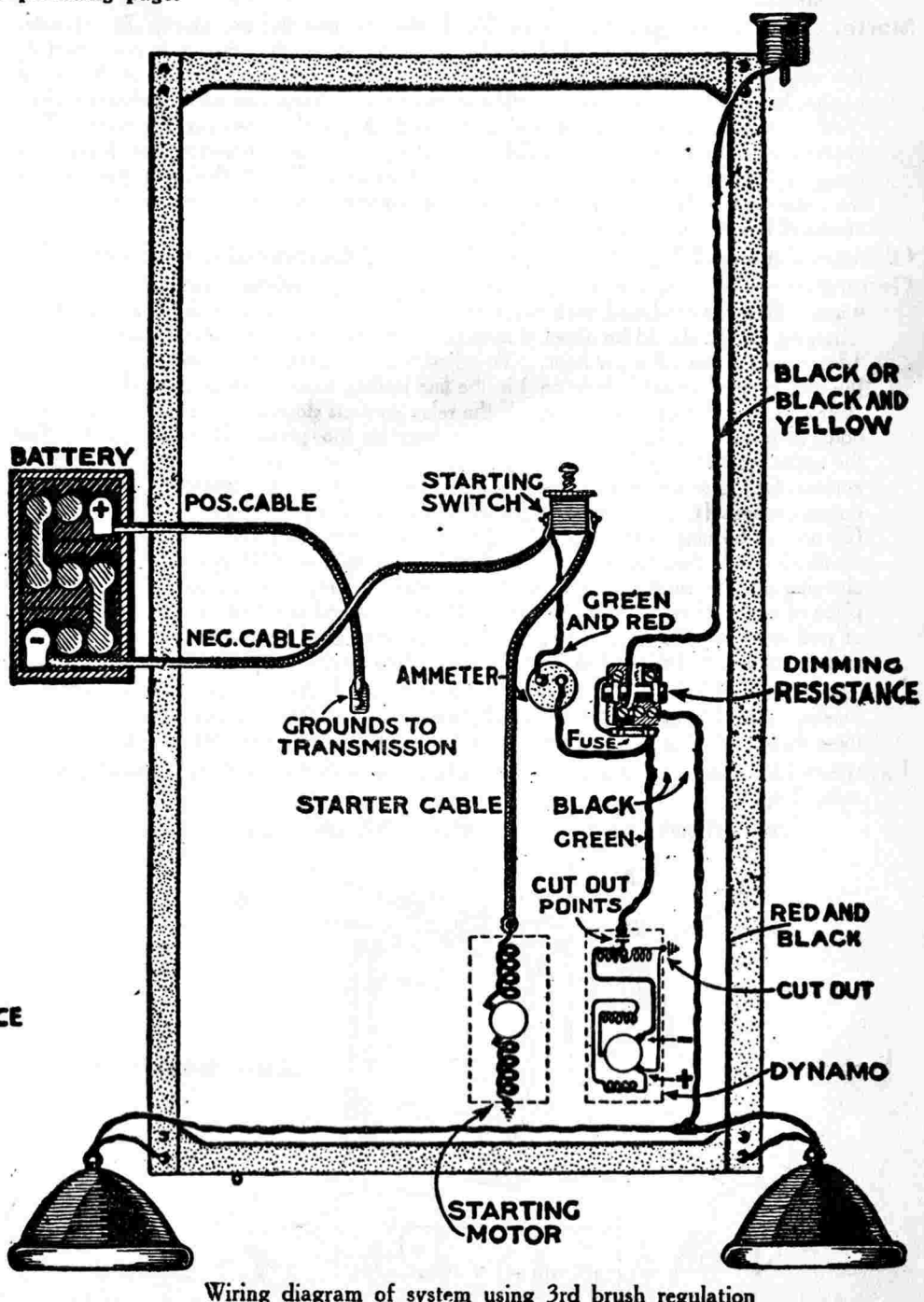
TWO UNIT, SINGLE WIRE, STARTING AND LIGHTING SYSTEM

Continued from preceding page.



Wiring diagram of system using regulator cutout

If the Units on the Car Resemble Plate B, Follow This Diagram



Wiring diagram of system using 3rd brush regulation

If the Units on the Car Resemble Plate C and Head Light Dimming Is Used

instead of Side Lamps, follow this diagram

Ford

Heinze-Springfield Starting and Lighting System

Battery.—Battery is 6 volts, 85 ampere-hour. The negative (—) terminal is grounded.

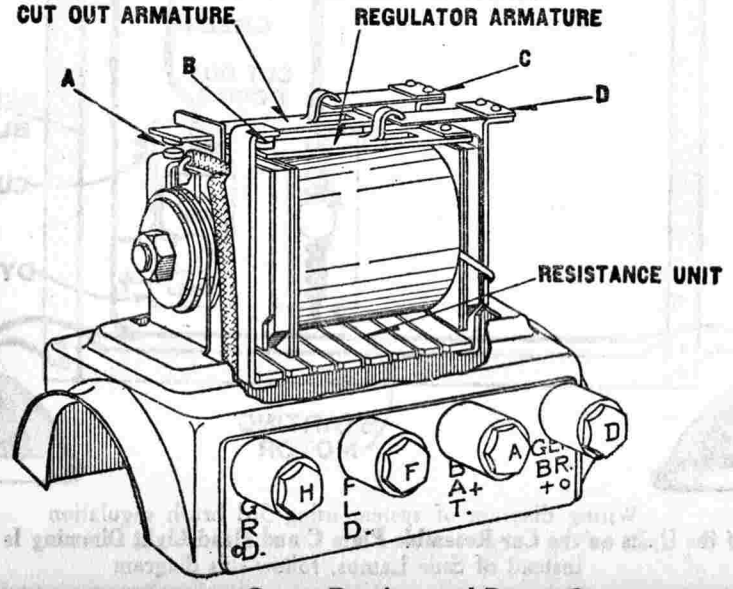
Starter.—Starter and generator are combined into one unit but are electrically separate. The motor armature is mounted above the generator armature. Starter is connected to the engine through a Bendix drive, engaging the gear on the generator shaft. Cold engine, heavy oil, tight bearings or other obstructions or damp, grounded or short circuited windings will cause high current and low speed during the cranking operation. Discharged, dry or sulphated battery, defective battery connections, defective switch contacts, defective starter connections, dirty commutator, high mica, dirty or sticking brushes, defective connections between armature coils and commutator bars or open circuits are the chief causes of low speed and low current.

Oiling.—Put several drops of light engine oil in each of the starter oilers every two weeks.

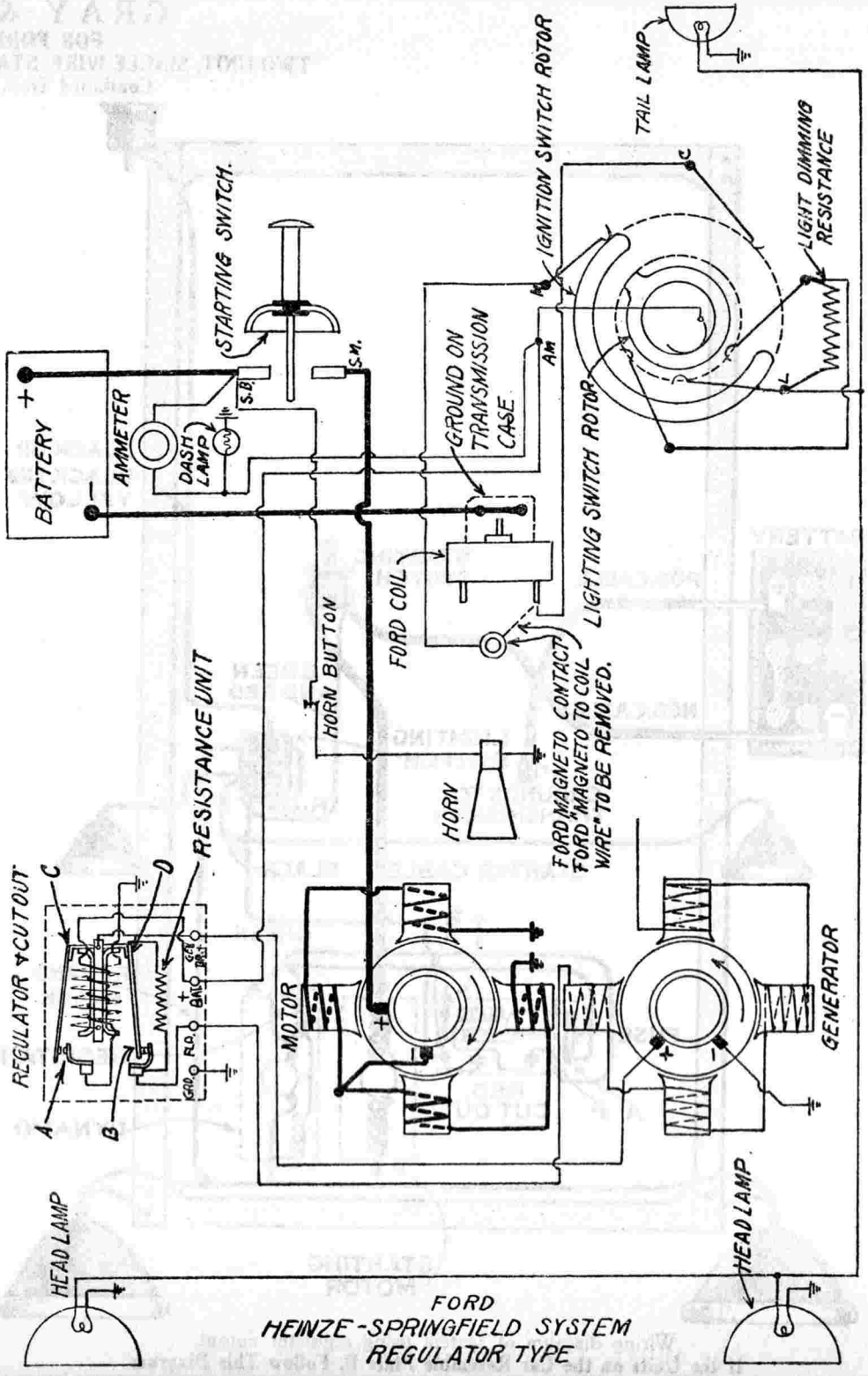
Generator.—Generator current regulation is by a vibrating regulator mounted on top of the frame. Relay is combined with regulator. Relay should close at six miles per hour. Charging current should be about 4 amperes at closing. Generator output should be 10-12 amperes at ten miles per hour. To adjust relay-regulator, first insert an ammeter (if the equipment does not include one) in the line leading from terminal marked "Bat +". Start engine and speed up slowly. If the relay contacts do not close at an engine speed equal to 6 miles per hour, the spring tension may be too great. Decrease by bending the upper support at (C). See that there is then sufficient spring tension to cause relay contacts (A) to separate when the discharge current reaches 0-2 amperes. If generator output exceeds 10-12 amperes at speeds above ten miles per hour, the regulator contacts (B) are not opening as they should. The spring tension on regulator armature (moving member) should then be decreased by bending the support (D) upward. To increase charging rate reverse this operation. Clean relay and regulator contacts by drawing a piece of unglazed paper between them. If badly burned or pitted, resurface with a piece of well worn No. 00 sand paper, drawing a piece of unglazed paper between them to remove all grit, and adjust before again putting into service.

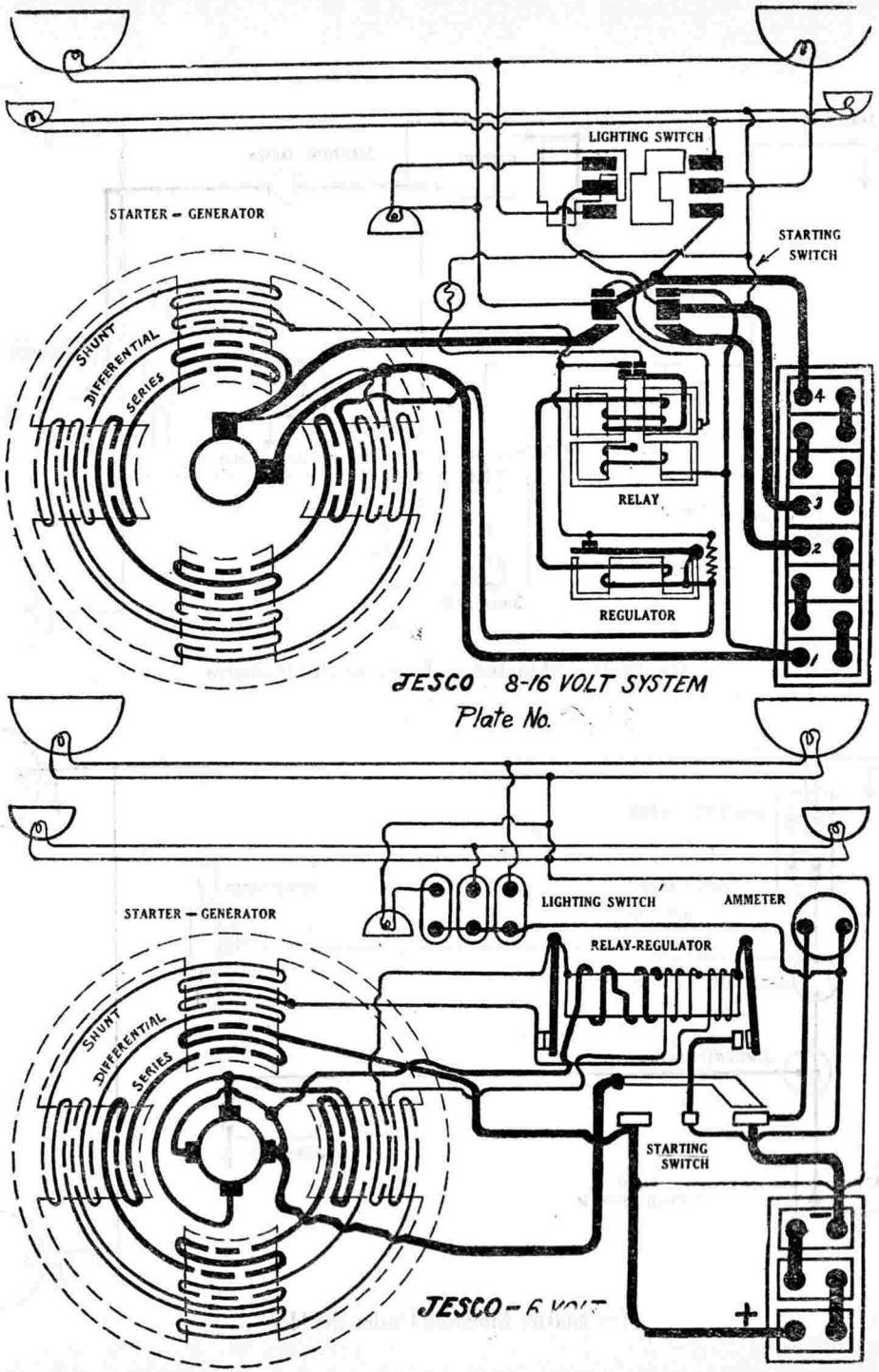
Oiling.—Put 4 or 5 drops of light engine oil in each of the generator oilers every two weeks. Also lubricate the chain with light engine oil at the same time. If car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

Lamps.—Head lamps are 9 volts, 21 cp. Dash lamp is 6-8 volts, 2 cp. Tail lamp is 6-8 volts, 2 cp.



Current Regulator and Battery Cutout





JESCO

GENERATING AND STARTING SYSTEM

8-16 VOLT SYSTEM

BATTERY.—Battery is 16 volt, 35 ampere-hour. Battery is divided into two sections of four cells and 8 volts each. The starting switch, when depressed, connects the two sections of the battery in series, providing 16 volts for operating the starter. When the switch is released and the upper contacts are closed, the two sections of the battery are connected in parallel for charging.

MOTOR-GENERATOR.—Starter and generator are combined into one unit. The unit is permanently connected to the engine crank shaft. Generator current regulation is by reverse field, the current through same being controlled by a vibrating regulator. The regulator, cut-out, starting switch and lighting switch are contained in one semi-circular case, usually mounted on the heel board below the driver's seat. The motor-generator has three field windings, as follows: A heavy series coil, the fine shunt coil and a third winding connected in series with the shunt winding and reversed with respect to it. The regulator contacts normally short-circuit this reversed field winding. When the regulator contacts open, the shunt field current must pass through the reversed coils, shunted by the regulator resistance, which reduces the magnetism and hence the current output of the generator. Maximum current output may be varied by means of a lever at the bottom of the controller case. Moving this lever to the right will increase the output and moving it to the left will have the opposite effect. Normal maximum output is 10-15 amperes.

6-VOLT SYSTEM

BATTERY.—Battery is 6 volt, 85-150 ampere-hour. The two-wire system is used.

MOTOR-GENERATOR.—Starter and generator are combined into one unit. The unit is permanently connected to the engine crank shaft. Generator current regulation is the same as that described above for the 8-16 volt system. The relay and regulator are combined into one unit and mounted on the motor-generator frame. The single core carries four windings: A coarse series coil connected in the charging circuit which actuates the regulator armature; a second coarse series coil and a fine shunt coil, comprising the usual relay windings; and a resistance coil, which is connected across the regulator contacts. Regulator is adjustable by turning a screw, which regulates the spring tension on the moving member. Turning this screw out will increase the maximum current output of the generator, and turning it in will have the opposite effect. The normal maximum current output is 15 amperes. Relay is adjusted by bending the bracket which supports the spring. Relay closes at 8-10 and opens at 6-8 miles per hour. Clean relay and regulator contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

Ford

Kemco Starting and Lighting System

Battery.—Battery is 6 volt, 100 ampere-hour. The negative (—) terminal is grounded.

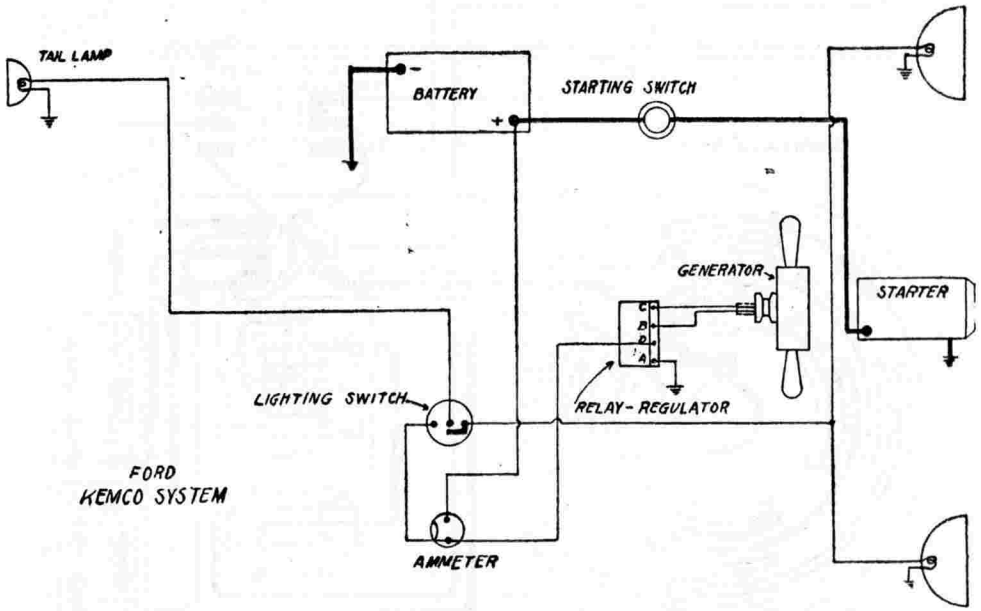
Starter.—Starter is chain connected to the engine crank shaft. It should deliver 16 pound-feet lock torque. Cold engine, heavy oil, tight bearings or other obstructions, or damp, grounded or short circuited motor windings or commutator bars will cause high current and low speed during the cranking operation.

Oiling.—Starter bearings are packed with soft cup grease. Put in 1 or 2 drops of light engine oil every month to keep grease soft.

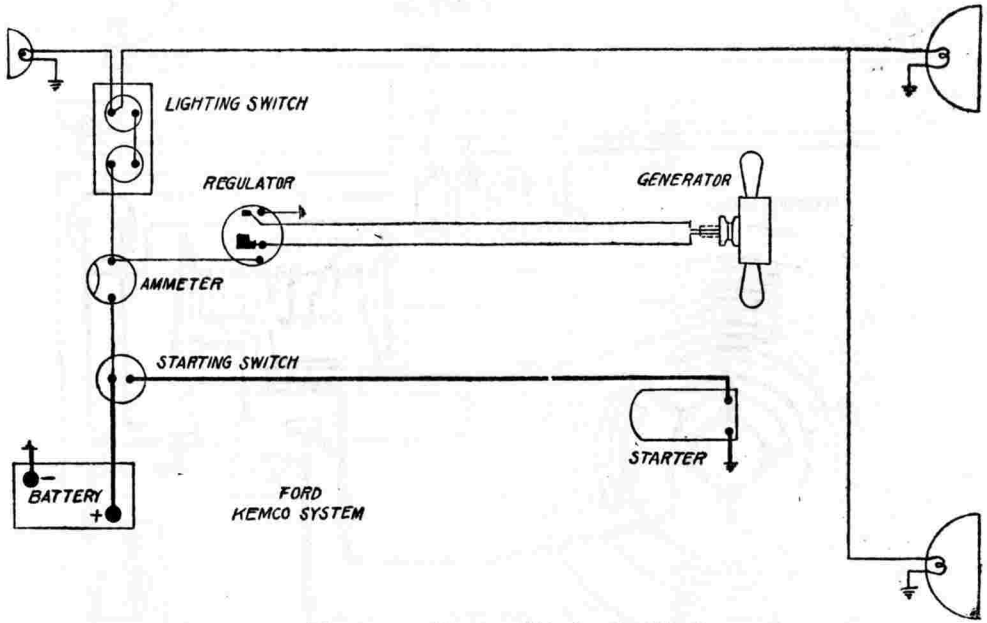
Generator.—Generator current regulation is by a vibrating type regulator. Relay is combined with regulator. Relay should close at 8 miles per hour (500 R. P. M. of generator). Maximum generator output of 12-14 amperes should be reached at 20 miles per hour (1250 R. P. M. of generator). Clean relay and regulator contacts by drawing a piece of unglazed paper between them. If badly burned or pitted, resurface with a piece of well worn No. 00 sand paper, drawing a piece of unglazed paper between them to remove all grit, and adjust before again putting into service.

Oiling.—Generator bearings are packed with soft cup grease. They should be thoroughly cleaned out and grease renewed every six months. Put in 1 or 2 drops of light engine oil every month to keep grease soft.

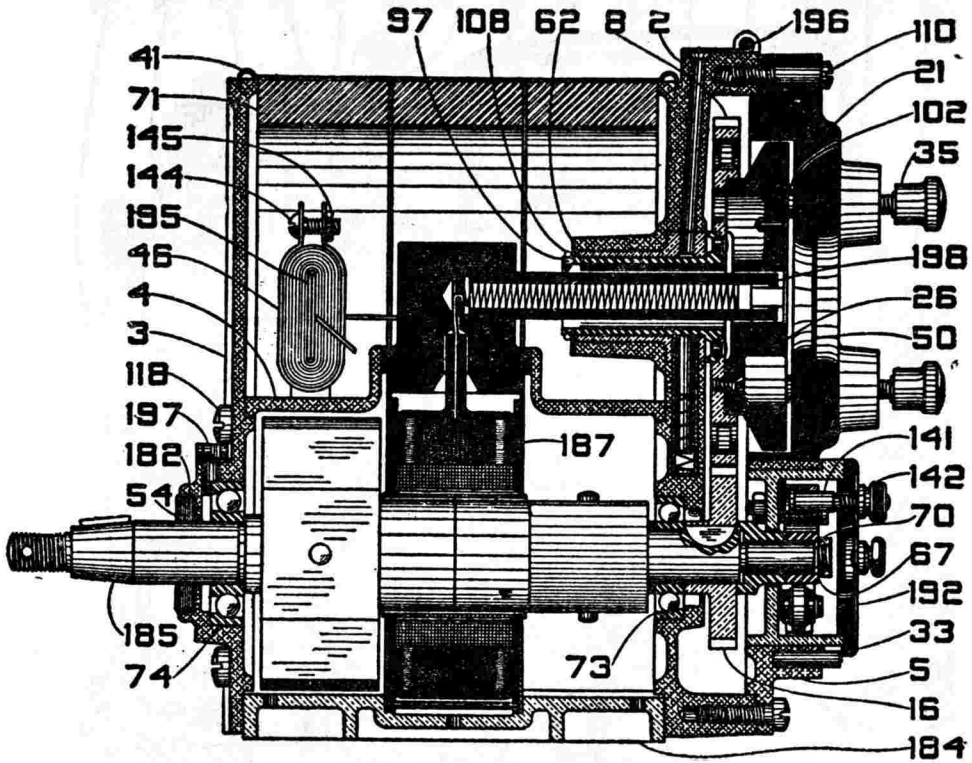
Lamps.—Head lamps are 6-8 volts, 17 cp. Tail lamp is 6-8 volts, 5 cp. Double contact base is used.

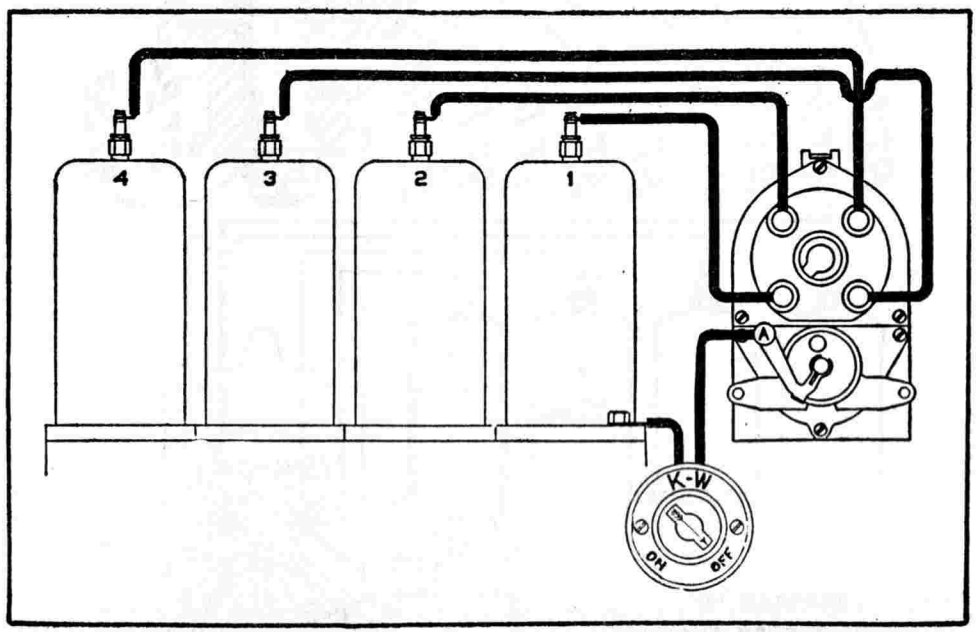


The Starter Mounted in Front of the Radiator



The Starter Mounted Under the Hood





Wiring Diagram

K-W MAGNETO

TYPES T AND TK, SINGLE-SPARK, INDEPENDENT

ROTATION.—Direction in which magneto must be driven is indicated by an arrow on the drive end bearing cap. To reverse direction of rotation, remove the breaker cam, turn it around end for end, and replace. Remove the three screws which hold the distributor moulding and segment to the large gear, and turn the moulding until the second set of screw holes in the gear are under those in the moulding. Replace the screws.

BREAKER.—Breaker contacts separate .016 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 2 or 3 drops of light engine oil in each of the oil holes every month. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

SPARK PLUG GAPS.—Spark plug gaps are .016 inch.

TIMING.—Turn the engine until the piston in cylinder No. 1 is in the position where the fully retarded spark is desired to occur. Turn the magneto shaft until the distributor segment is making connection with brush No. 1, which is the lower left hand terminal post. (The segment can be seen through the window in the center of the distributor block.) Place the breaker housing in the fully retarded position by turning it as far as it will go in the direction of armature rotation. Then turn the armature shaft very slightly in either direction until the breaker contacts are just beginning to separate. Couple the magneto to the engine, being careful not to disturb the relative position between the armature shaft and driving member. Connect No. 1 terminal to the plug in No. 1 cylinder, and the other terminals and plugs in accordance with the firing order of the engine.

IMPULSE STARTER.—To time Type TK magneto with impulse starter, trip the starter dog into engagement. Turn the impulse starter until the cam on the starter case is beginning to raise the dog out of engagement. This is the proper position of shaft for coupling to the engine.

K-W MAGNETO

TYPES H, HT AND HK, SINGLE-SPARK, INDEPENDENT

ROTATION.—Direction in which the magneto must be driven is indicated by an arrow on the drive end bearing dust cap. To reverse the direction of rotation of magnetos not equipped with impulse starter, remove the breaker cam, turn it around end for end and replace. Remove the distributor disc moulding from the large distributor gear, by removing the three screws. Turn the disc until the second set of screw holes in the gear are under those in the disc. Replace the screws.

BREAKER.— Breaker contacts separate .016 inch. They are made of platinum-iridium. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper. There is a hole provided in the side of the breaker box in order that contact gap may be conveniently adjusted. The entire breaker assembly may be easily removed by pushing the contact spring aside.

OILING.—Put 2 or 3 drops of light engine oil in each of the oilers every month and put 1 drop on the wick in the roller on the upper contact arm of the breaker. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Place the rocker arm (A) in the horizontal position. (See Plate 158A.) Turn the shaft of the magneto until the distributor brush is in contact with the segment (S), which connects with the No. 1 terminal. Then turn the shaft very slightly in either direction until the breaker contacts (P) are just separating. Couple the magneto to the engine, being careful not to alter the relative position between the armature shaft and driving member. Connect the distributor terminal No. 1 to the plug in No. 1 cylinder. Connect the other terminals and plugs in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .016 inch.

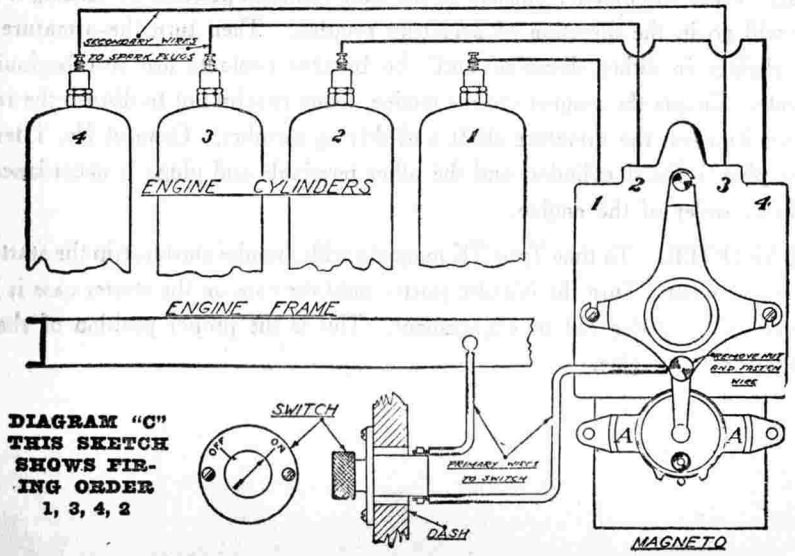
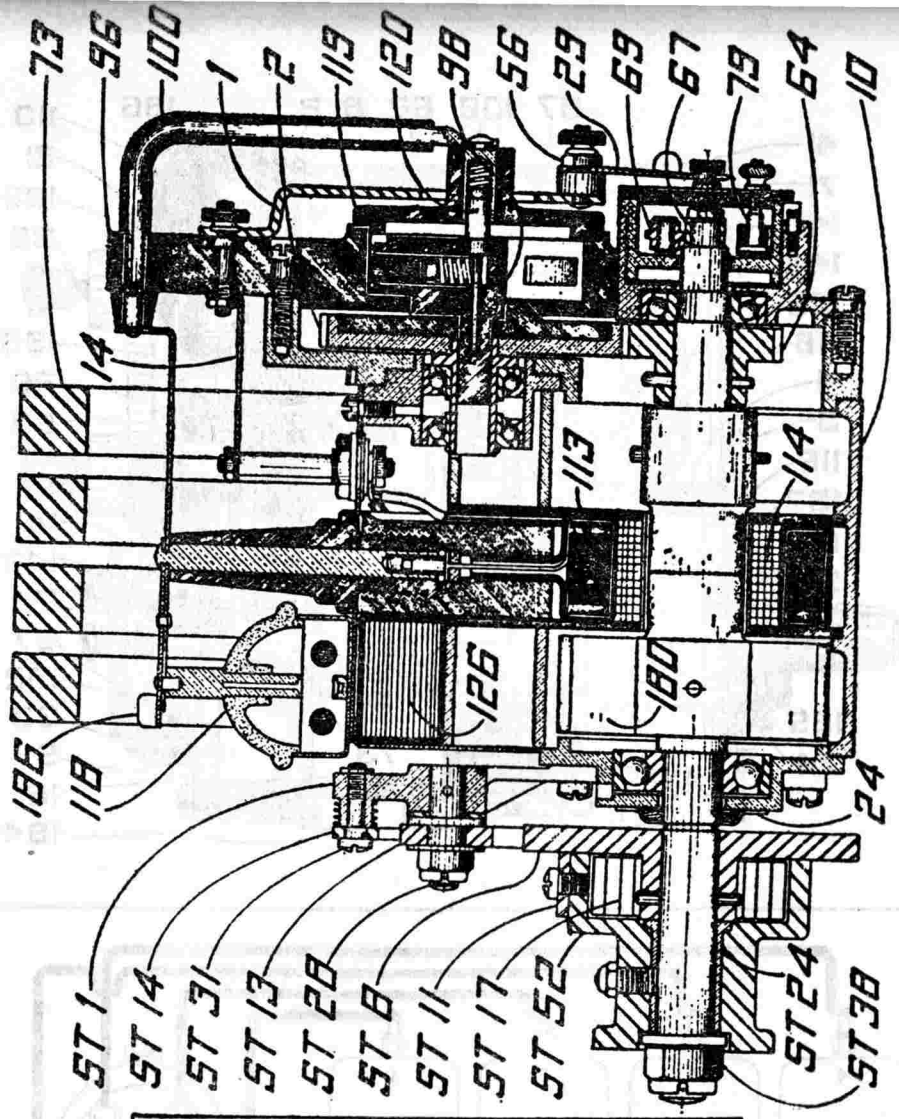


DIAGRAM "C" THIS SKETCH SHOWS FIRING ORDER 1, 3, 4, 2



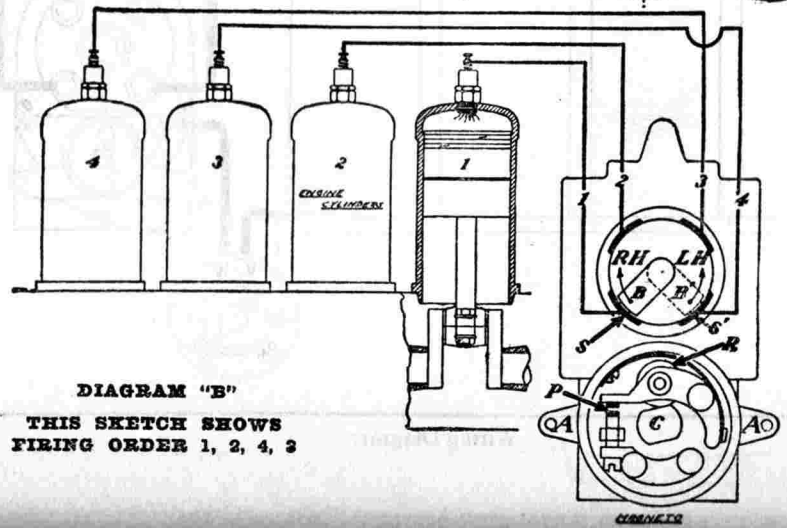
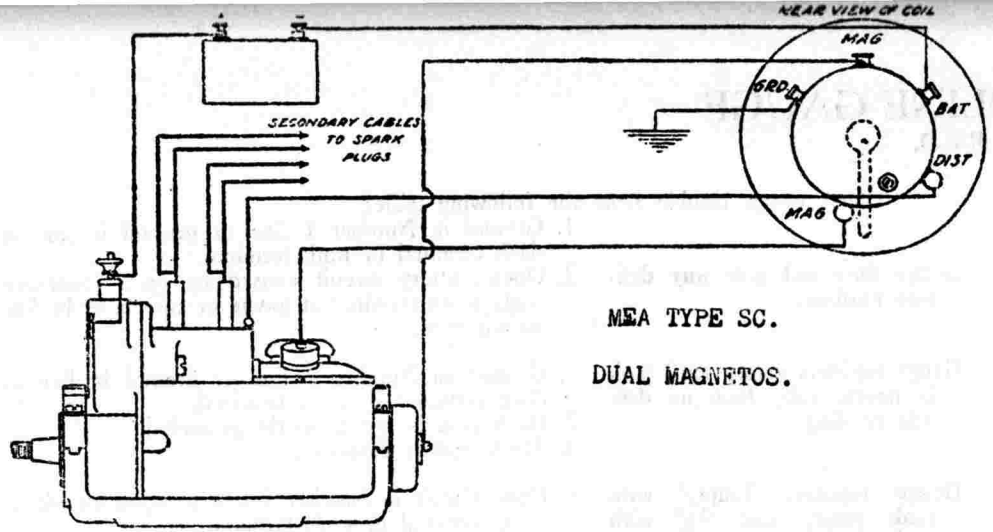
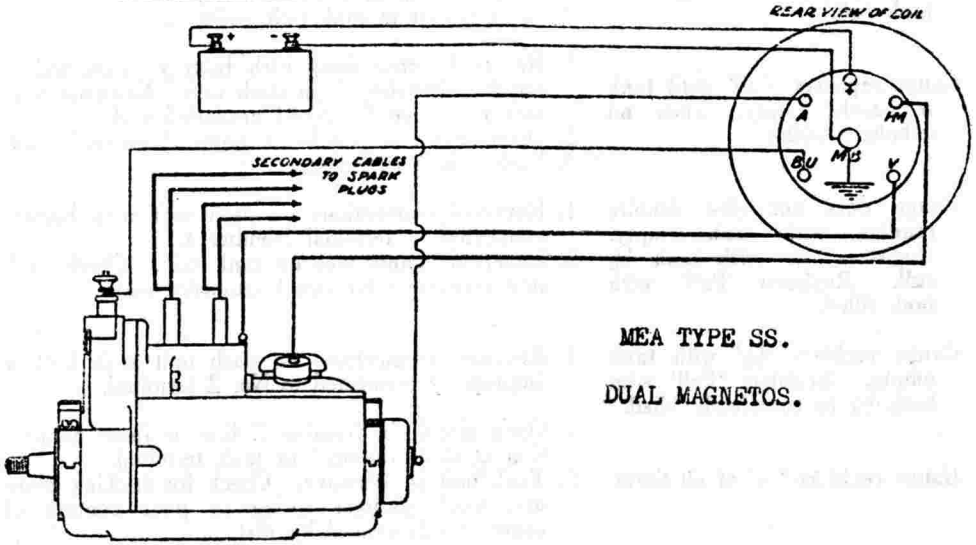


DIAGRAM "B" THIS SKETCH SHOWS FIRING ORDER 1, 2, 4, 3



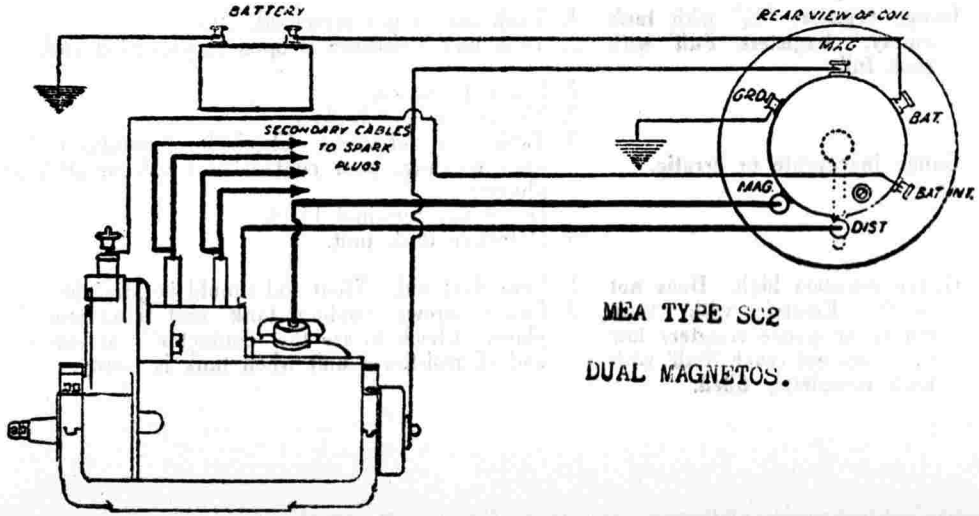
MEA TYPE SC.

DUAL MAGNETOS.



MEA TYPE SS.

DUAL MAGNETOS.



MEA TYPE SC2

DUAL MAGNETOS.

MEA MAGNETO

TYPES SC, SC2 AND SS, SINGLE-SPARK, DUAL

BREAKER.—Breaker contacts separate .016 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 2 or 3 drops of light engine oil in each of the oilers every two weeks. If the car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully advanced spark is desired to occur. Turn the magneto shaft until No. 1 appears in the window in the front plate of magneto. Place the breaker in the fully advanced position by turning as far as it will go against the direction of armature rotation. Then turn the shaft very slightly in either direction until the breaker contacts are just beginning to separate. Couple the magneto to the engine, being careful not to disturb the relative position between armature shaft and driving member. Connect the No. 1 terminal on the distributor block of the magneto to the plug in No. 1 cylinder, and the other terminals and plugs in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .016 inch.

SPECIAL.—Never remove the top cover supporting the high tension carbon while the magneto is running, as this cover contains the safety gap, and the insulation of the windings is apt to be punctured if magneto is turned while it is off.

Remove the magneto from the base when bolting the latter to the frame, and see that the bolts do not project across the inside surface of the base, otherwise they may injure the magneto housing. In tightening the nut at the front end of the armature shaft hold the shaft by the coupling. Do not try to prevent it from turning by holding the breaker.

The breaker may be easily removed from the case by removing the long center screw holding the breaker to the armature shaft, and screwing it into the small tapped hole provided in the breaker base, so that it may be used as a handle to lift the breaker out. In replacing the breaker, the small pin at its back must be introduced into the slot provided in the armature. Care must be taken not to tighten the screw before this pin is in place.

If magneto has been taken down, it is important that the armature and the distributor gears be placed in the proper relative position to each other. To facilitate so placing them, three holes are drilled in the end shield, the distributor gear and the end plate of the armature, in such a position, that if the three parts in question are in line, the relation betwee narmature, breaker and distributor is connect. In assembling, all that is necessary is to insert a pin into the hole in the end shield and set gears so that pin will pass through all three holes.

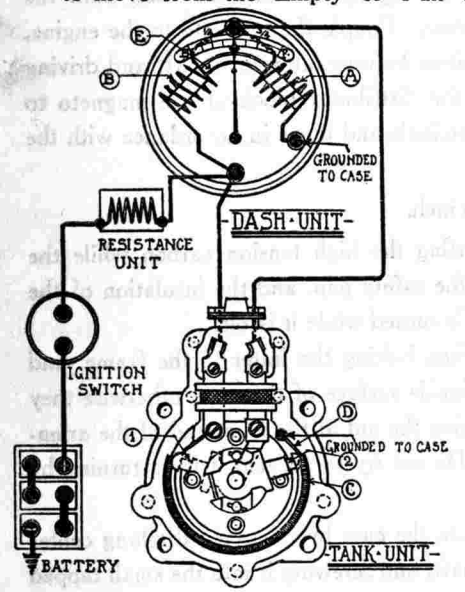
NAGEL GASOLINE GAUGE

Model R.K.D.

Electric Gasoline Gauges will be found as standard equipment on a large number of passenger car models. These units do not require attention in service other than tests to locate trouble when the gauge does not register correctly. As long as the gauge works properly no attention is necessary.

DESCRIPTION:—The Model R.K.D. gauge consists of two parts, the recording gauge mounted on the dash and the tank unit mounted on the gasoline tank at the rear of the car. They are connected by two wires running along the car frame from the dash to the tank. A lead from the No. 1 terminal of the dash unit is connected to the ignition terminal of the switch or directly to the ammeter through a special resistance unit. It is important that this resistance be wired in the circuit.

OPERATION:—The gauge is an accurate current balancing device with two coils 'A' and 'B'. A variable resistance 'C' in the tank unit is cut in or out of each coil circuit by the action of the float in the gasoline tank rising or falling with the gasoline level. The magnetic action of the coils causes the pointer of the gauge to move from the 'Empty' to 'Full' as the float rises in the tank. Since one coil is balanced against the other a variation of the battery voltage has no effect on the reading of the gauge and a correct reading will be obtained with a discharged battery as well as when the battery is fully charged. When the gas tank is entirely empty and the float is at its lowest position the contact arm 'D' of the tank unit will be in position 1 and the resistance 'E' will be entirely in series with coil 'A' and will be entirely out of the circuit of coil 'B'. Coil 'B' will thus draw a slightly greater current from the battery and the greater magnetic attraction will draw the circular solenoid 'E' around so that the pointer attached to the solenoid will register 'Empty' on the gauge. As the gasoline level and the float rise in the gasoline tank the contact arm 'D' moves along the resistance unit cutting the resistance out of the coil 'A' circuit and in the circuit of coil 'B'. At the top of the stroke with the gasoline tank full the contact arm reaches position 2 with the resistance entirely cut out of the coil 'A' circuit and entirely in series with coil 'B'. At this point the solenoid has reached a position in coil 'A' and the pointer indicates 'Full'. When the ignition switch is turned off the gauge becomes inoperative and the pointer may rest in any position. It will be necessary to switch the ignition on momentarily to secure a gauge reading.



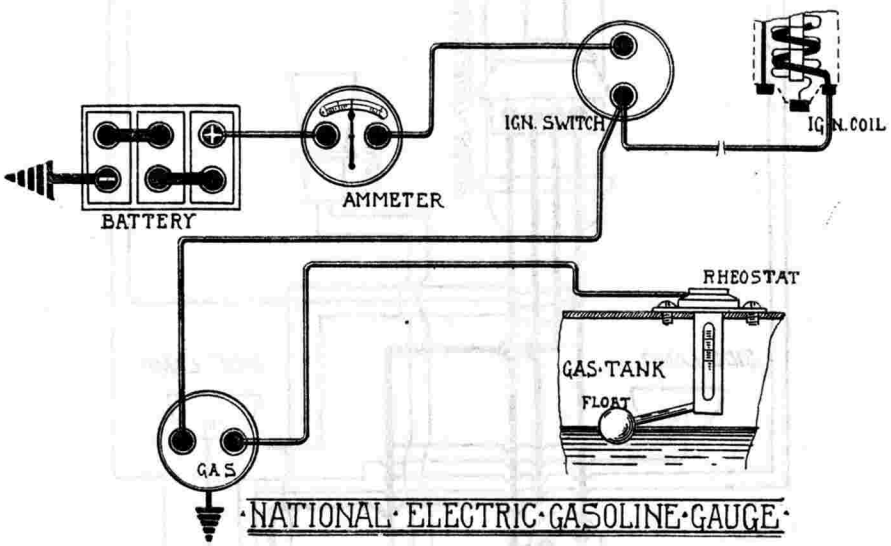
MOUNTING:—It is very important that the wiring of the instrument is exactly as shown. The gauge will not operate correctly with reversed connections. Both the dash unit and the tank unit must be grounded. If the gauge is mounted on a wooden dash it will be necessary to run a wire from one of the mounting screws on the case to the engine block or to the car frame. The tank unit must be well grounded to the gasoline tank.

TROUBLE SHOOTING:—Minor adjustments can be made on the tank unit. No attempt should be made to repair the dash unit and it should be returned to the manufacturer for repairs if tests indicate that it is defective. Neither dash unit or tank unit require lubrication in service. In making tank unit repairs use alcohol to clean parts. Do not use gasoline or oil.

Check gauge trouble from the following table:

Gauge does not give any definite reading.	1. Ground in Number 1 line or ground in line at dash terminal or tank terminal. 2. Open battery circuit caused by open resistance unit, loose terminal at gauge or switch, or broken switch wire.
Gauge registers empty until tank is nearly full; then no definite reading.	1. Ground in Number 2 line or ground in line at dash terminal or tank terminal. 2. Dash unit is not properly grounded. 3. Dash unit is defective.
Gauge registers 'Empty' with tank empty and '¼' with tank full.	1. Open circuit in Number 1 line or open circuit at dash terminal or tank terminal. 2. Open circuit in tank unit resistance.
Gauge registers 'Full' until tank is nearly empty. Then no definite reading.	1. Reversed connections with battery connected to terminal Number 2 on dash unit. Examine tank unit resistance for fused grounded end. 2. Open circuit at Number 1 terminal on dash unit. 3. Dash unit is defective.
Gauge does not give definite reading with tank empty. Registers '¾' with tank ¼ full. Registers 'Full' with tank filled.	1. Reversed connections on dash unit with battery connected to terminal Number 1. 2. Reversed connections on tank unit. Check tank unit resistance for fused grounded end.
Gauge registers '½' with tank empty. Registers 'Full' with tank ¼ to completely filled.	1. Reversed connections on dash unit with battery improperly connected to No. 2 terminal.
Gauge registers '½' at all times.	1. Open circuit in Number 2 line or loose connection at dash terminal or tank terminal. 2. Tank unit is defective. Check for sticking plunger, weak plunger spring or poor contact of center brush caused by dirt.
Gauge registers '¾' with tank empty. Registers 'Full' with tank full.	1. Tank unit is not grounded. 2. Tank unit resistance is open at grounded end.
Gauge inaccurate or erratic.	1. Loose terminals. 2. Number 2 line broken. 3. Tank unit defective. Check for irregular resistance winding, poor contact of brush or sticking plunger. 4. Damp car terminal block. 5. Defective dash unit.
Gauge registers high. Does not reach 'Empty' with tank empty or gauge registers low and does not reach 'Full' with tank completely filled.	1. Bent float rod. Float rod should be straight. 2. Loose screws holding tank unit contactor in place. Check to see that contactor is at extreme end of resistance unit when tank is empty.

NATIONAL GASOLINE GAUGE



DESCRIPTION:—The National Gasoline Gauge is of the balanced coil type and consists of a dash recording unit and a tank resistance or variable resistance connected to a float in the gasoline tank. The gauge operates only when the ignition switch is on and indicates 'Empty' with the switch off. With engine stopped it will be necessary to turn the switch on to secure a correct reading. The gauge is not affected by changes in battery voltage and will give a correct reading with a discharged battery.

MOUNTING:—Both the dash unit and the tank unit should be grounded. If the gauge is mounted on a wooden dash it will be necessary to run a wire from the gauge case to the engine block or car frame. The tank unit is grounded through the mounting screws. One wire from the 'Ga' terminal on the dash unit runs to the terminal on the tank unit. A second wire from the dash unit terminal 'IGN' SW' should be connected to the coil terminal of the ignition switch. Make certain that all connections are tight..

TROUBLE SHOOTING:—If gauge does not register correctly in service first check for loose connections at switch, dash unit, or tank unit and check lines for broken wires. Make certain that both dash unit and tank unit are properly grounded. Then make the following tests:

Defective Dash Unit.—Turn on ignition switch. Remove wire at tank unit. Gauge should register 'Empty'. Ground wire to car frame. Gauge should register 'Full'. If it does not the dash unit is defective.

Defective Tank Unit.—If the above tests indicate that the dash unit is operating correctly and the gauge will not operate in service, the tank unit is probably defective.

Do not attempt to make repairs to either the dash unit or tank unit. The manufacturer will replace all defective instruments.

North East System

1913

For Columbus, Galt, Havers, Imperial 34, Marmon 32, Michigan, Pullman and Warren Cars

Battery.—Battery is 16 volt, 50 ampere-hour. There is a tap taken off the middle connector to supply 8 volts for lights and horn. The two wire system is used.

Starter-Generator.—Starter and generator are combined into one unit. Armature is connected to the engine through a set of reduction gears and an overrunning clutch. Either Model A, Type 1000 or Model A, Type 2000 motor-generator may be used. Type 1000 rotates counter-clockwise. Type 2000 rotates clockwise. Starter should deliver 12 pound-feet torque when taking 46 amperes. Less torque with this current indicates damp, grounded or short circuited motor windings or commutator bars, field connected wrong, tight bearings or armature striking pole pieces. Cold engine, heavy oil, tight bearings or other mechanical obstructions, or damp, grounded or short circuited motor windings or commutator bars will cause low speed and excessive current, during the cranking operation. Discharged, dry or sulphated battery, defective battery connections, defective switch contacts, defective motor connections, sticking brushes, dirt, commutator, high mica or broken connections between armature coils and commutator bars are the chief causes of low speed with low current during cranking operation or when testing starter for torque as above.

Generator.—Generator current regulation is by reverse series field and a vibrating regulator. Generator should normally deliver 7 amperes.

Oiling.—Keep a liberal amount of grease in the reduction gear case at all times. Put several drops of light engine oil in the bearing oilers every two weeks. If car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

Continued on next page.

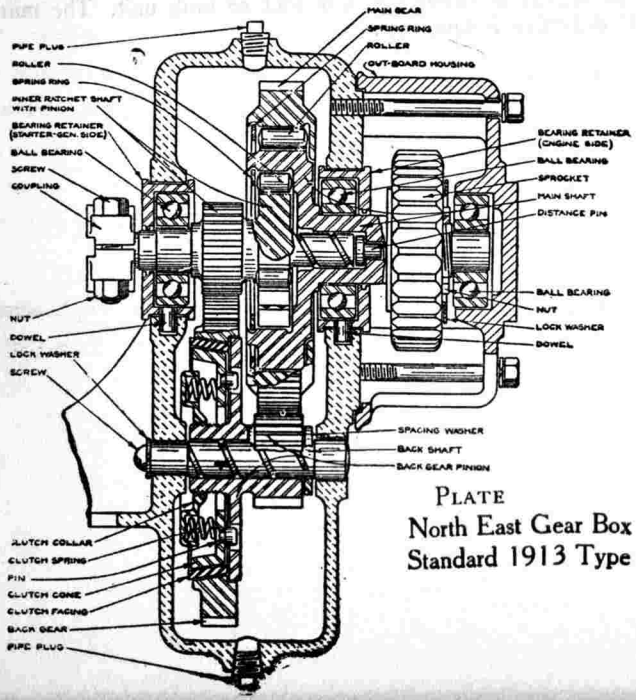
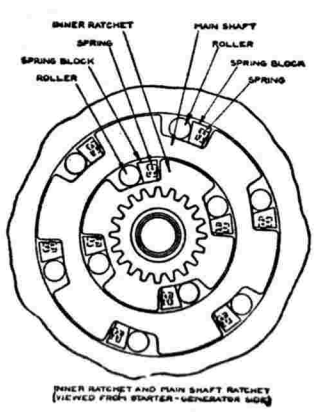
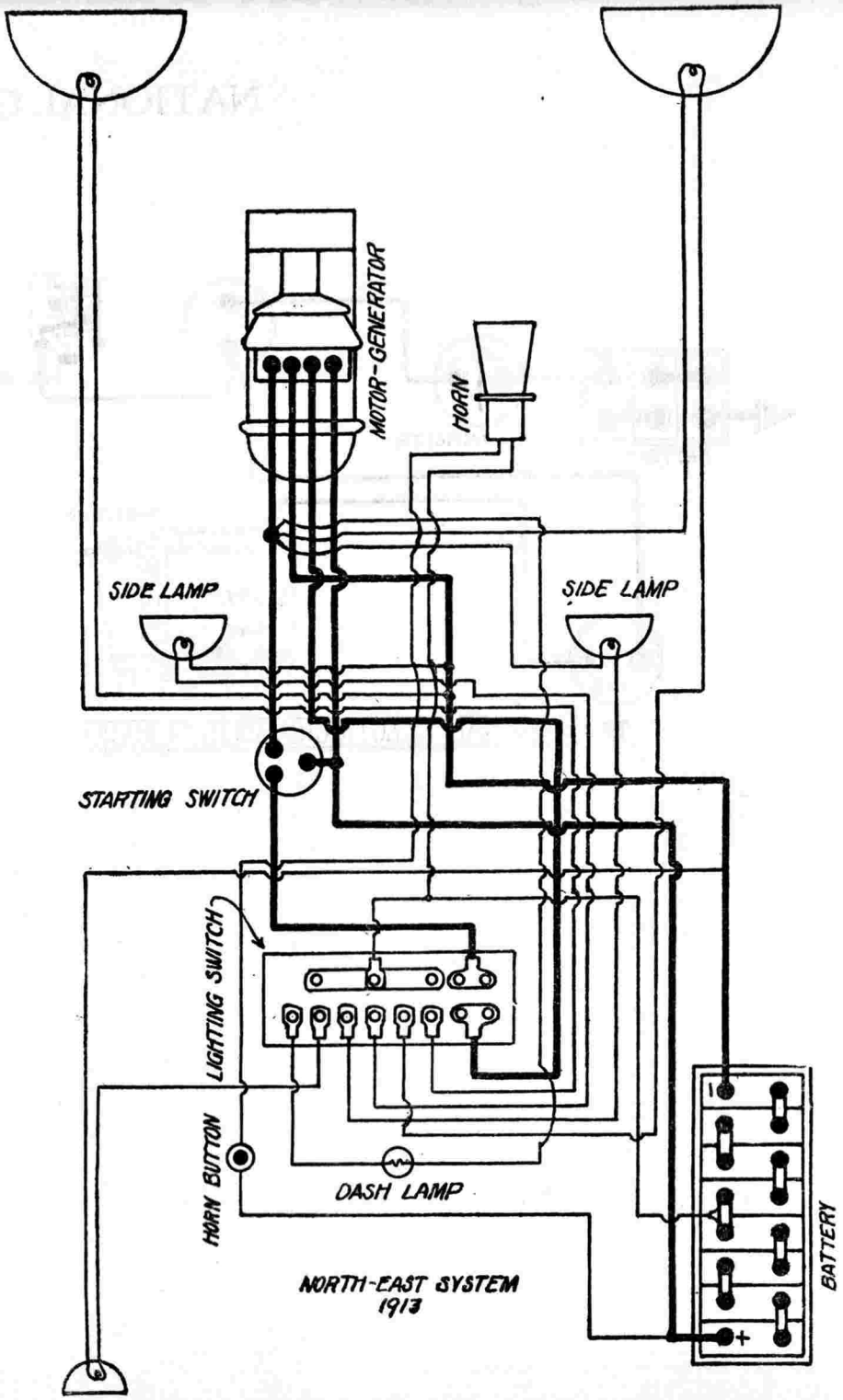


PLATE
North East Gear Box
Standard 1913 Type



INNER RATCHET AND MAIN SHAFT RATCHET (VIEWED FROM STARTER-GENERATOR SIDE)



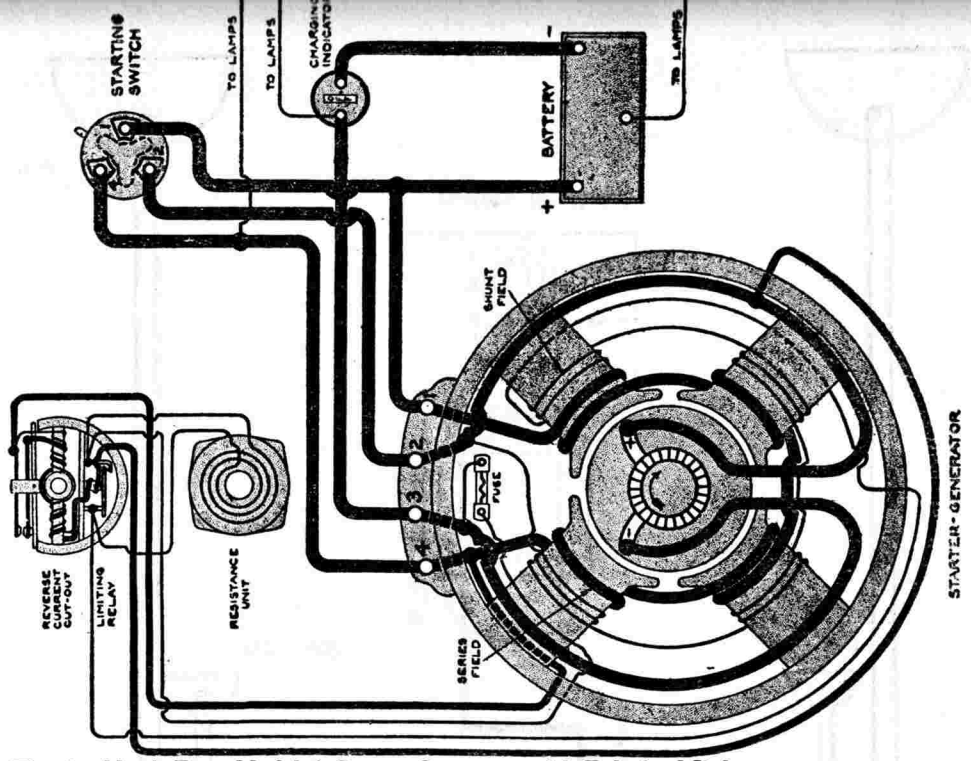


Fig. 1. North East, Model A Starter-Generator with Polarized Relay

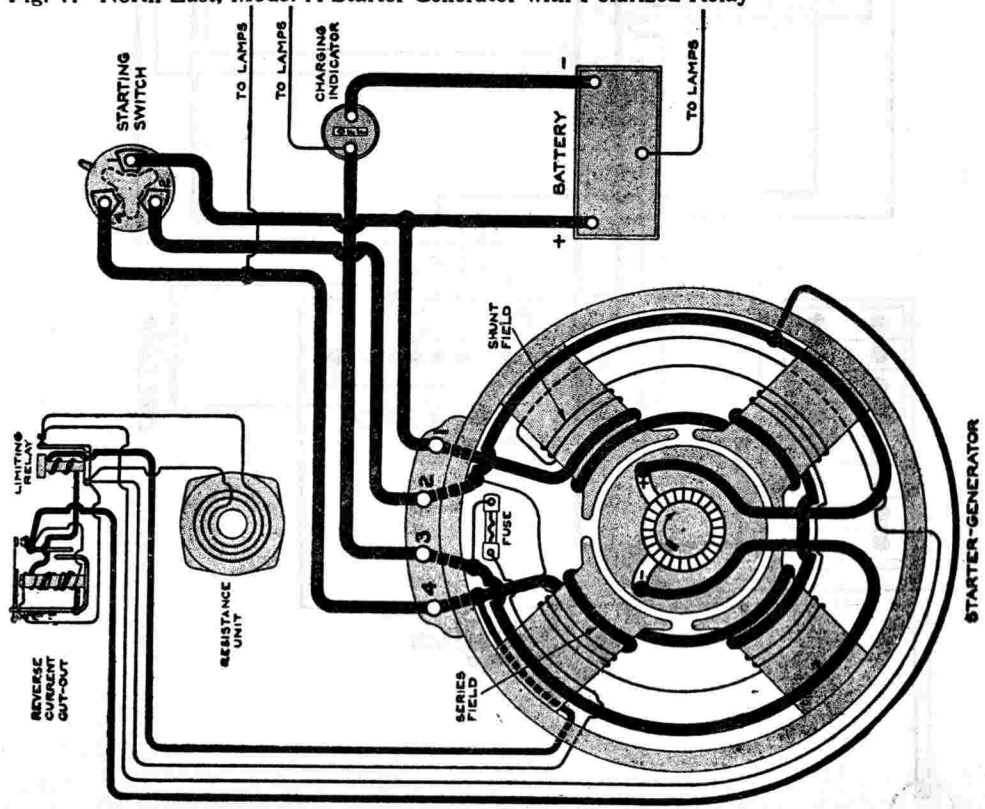


Fig. 2. North East Model A Starter-Generator with Magnetic Relay.

NORTH EAST SYSTEM

1913

FOR COLUMBUS, GALT, HAVERS, IMPERIAL 34, MARMON 32, MICHIGAN, PULLMAN AND WARREN CARS

Relay-Regulator.—Relay is combined with regulator. Two types of relay regulators may be found in use. Circuits when the polarized type is used are shown in Fig. 1. Circuits when the later or electro-magnetic type relay-regulator is used are shown in Fig. 2. In case it is necessary to make more than very minor repairs on the old (No. 1900) type regulator it is advisable to replace the regulator with a new (No. 1197), improved type regulator. To install this new unit it is necessary to cut out the bosses on the commutator end bearing in which the studs holding the original relay were screwed, to provide the clearance required to prevent grounding of the nuts which secure the units to their baseboard. As a further precaution against grounding, cut away that portion of the gasket retainer which would be liable to come in contact with the relay armature (moving member). Fasten down the baseboard by screwing the resistance unit studs into the holes used by the former unit. Before connecting relay, draw out all leads to take up any slack inside of starter generator and secure, to prevent their working back. Any loose wires inside frame have a tendency to be drawn between armature and pole pieces. Connect as shown in diagram and adjust. Relay should close at 1000 R. P. M. of generator armature. Charging current should be 3 to 4 amperes at closing and the discharge current 0 to 1 amperes at opening of relay contacts. Generator should normally deliver 7 amperes. Output may be increased by increasing spring tension, and decreased by decreasing spring tension. Air gap between regulator coil core and armature (moving member) should be .025 inch. Air gap between relay armature (moving member) and coil core should be .030 inch. Decreasing gap will decrease cut in and increase cut out current. By proper combination of these two adjustments the desired relay-regulator action may easily be obtained. Clean relay and regulator contacts by drawing a piece of unglazed paper between them. If burned or pitted, resurface with a piece of well worn No. 00 sand paper, drawing a piece of unglazed paper between them, to remove all grit, and adjust before again putting into service. There is a 5 ampere fuse in the shunt field circuit, mounted on generator frame.

Lamps.—Head lamps are 8½ volts, 15 cp. Side lamps are 6-8 volts, 4 cp. Dash lamps are 6-8 volts, 2 cp. Tail lamp is 6-8 volts, 2 cp. Some of the Marmon cars were equipped with 24 cp. head lamps. Double contact base is used on all lamps.

Fuse.—Generator fuse is 5 ampere.

North East Starting and Lighting System

For Marmon 48 (1913-14)
Cunningham Model M, Havers 44 and 45
Imperial 32, 34, 49, 44, 54, 56 and
Marmon 41 (1914)

Battery.—Battery is 16 volt, 35 ampere-hour, on Imperial cars, and 16 volt, 50 ampere-hour on all other cars. There is a tap taken off the middle cells to supply 8 volts to lamps and horn. The two wire system is used.

Starter-Generator.—Starter and generator are combined to form a single unit. When operating as a starting motor the unit is connected to the engine through a set of reduction gear and an overrunning clutch. It should deliver 20-22 pound-feet lock torque, taking 80-95 amperes at 6.25 volts, voltage measured across brushes. Cold engine, heavy oil, tighs bearings or other obstructions, or damp, grounded or short circuited windings will cause high current and low speed during the cranking operation. Discharged, dry or sulphated battery, defective battery connections, defective switch contacts, defective starter connections dirty commutator, high mica, dirty or sticking brushes, defective connections between armature coils and commutator bars or open circuits are the chief causes of low speed and low current.

Generator.—The unit operates as a generator when engine is running and starter pedal is released. Generator current regulation is by a vibrating regulator. Generator output should be 6 amperes at 1500-3000 R. P. M. of armature.

Oiling.—Put 4 or 5 drops of light engine oil in each of the motor-generator bearing oilers every two weeks. It car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles. Keep a liberal amount of grease in the reduction gear case at all times.

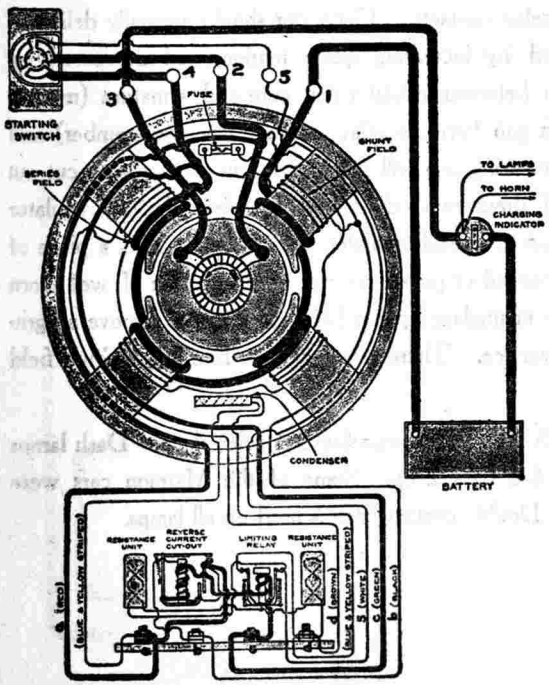
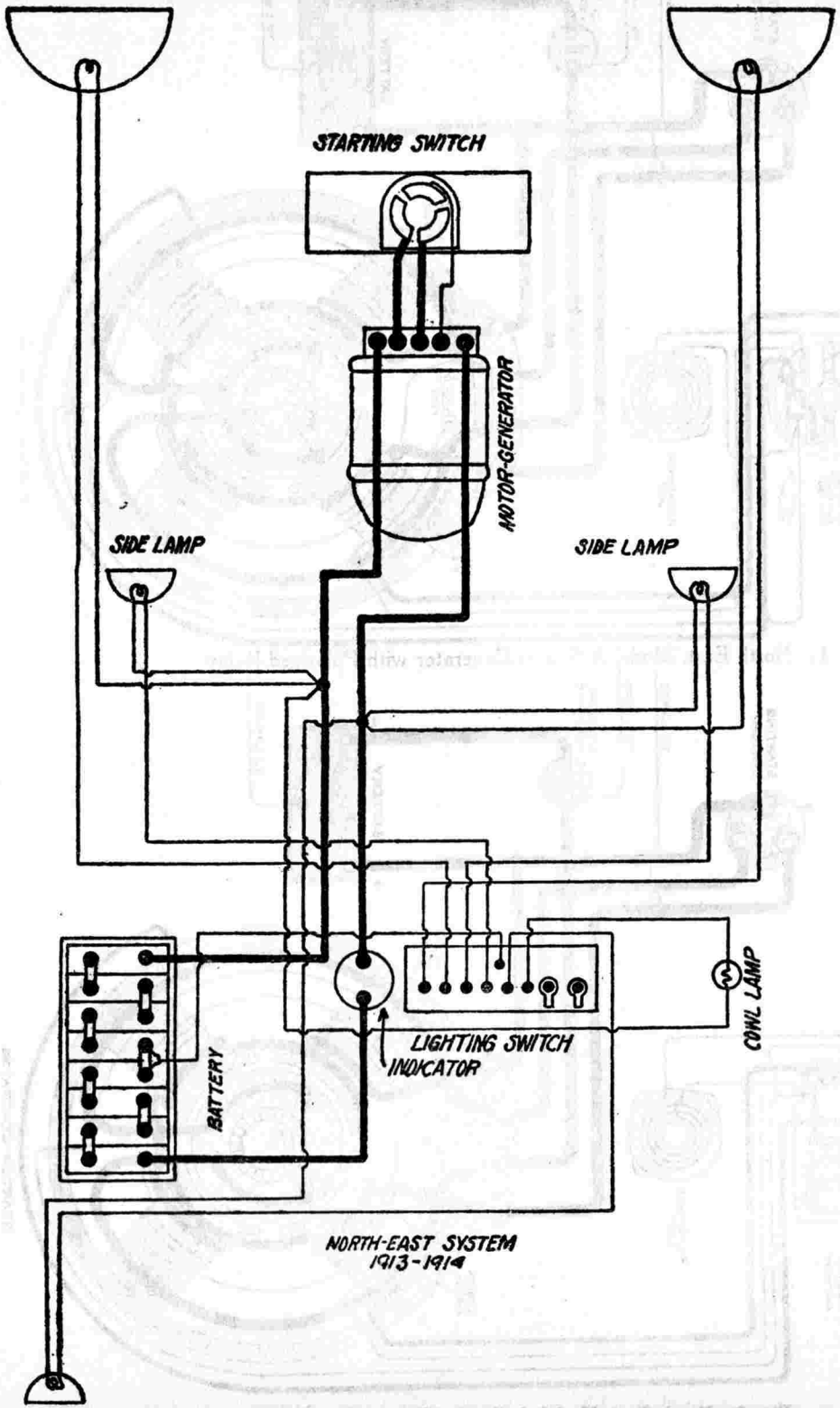


Plate
North East Model B System

Relay-Regulator.—Relay is combined with regulator. Relay should close when pressure of generator reaches 20 volts. Generator must be driven 1000 R. P. M. to produce this pressure. The charging current should be 2-3 amperes at closing and the discharge current 0 to 1 ampere at opening of relay contacts. Air gaps between relay armature and coil core should be .030 inch. To increase output of generator, increase spring tension on regulator armature (moving member). To decrease output, decrease spring tension. Air gaps between regulator armature and coil core should be .025 inch. There are two resistance units, each having a resistance of 14 ohms. Clean relay and regulator contacts by drawing a piece of unglazed paper between them. If badly burned or pitted, resurface with a strip of well worn No. 00 sandpaper, drawing a piece of unglazed paper between them to remove all grit. Adjust before again putting into service.

Lamps.—Head lamps are 8½ volts, 15 cp. Side lamps are 8½ volts, 4 cp. Dash and tail lamps are in series. They are 3-4 volts, 2 cp.



Ford

North East, 24 Volt, Starting and Lighting System

Battery.—Battery is 24 volt, 25 ampere-hour. The two wire system is used.

Starter.—Starter and generator are combined to form a single unit. Starter should deliver 36 pound-feet torque when taking 150 amperes. Cold engine, heavy oil, tight bearings, or other obstructions or damp, grounded or short circuited windings will cause high current and low speed during the cranking operation. Discharged, dry or sulphated battery, defective battery connections, defective switch contacts, defective starter connections, dirty commutator, high mica, dirty or sticking brushes, defective connections between armature coils and commutator bars or open circuits are the chief causes of low speed and low current.

Oiling.—Motor-generator bearings are packed with soft cup grease. They should be thoroughly cleaned out and grease renewed once a season. No oil is required.

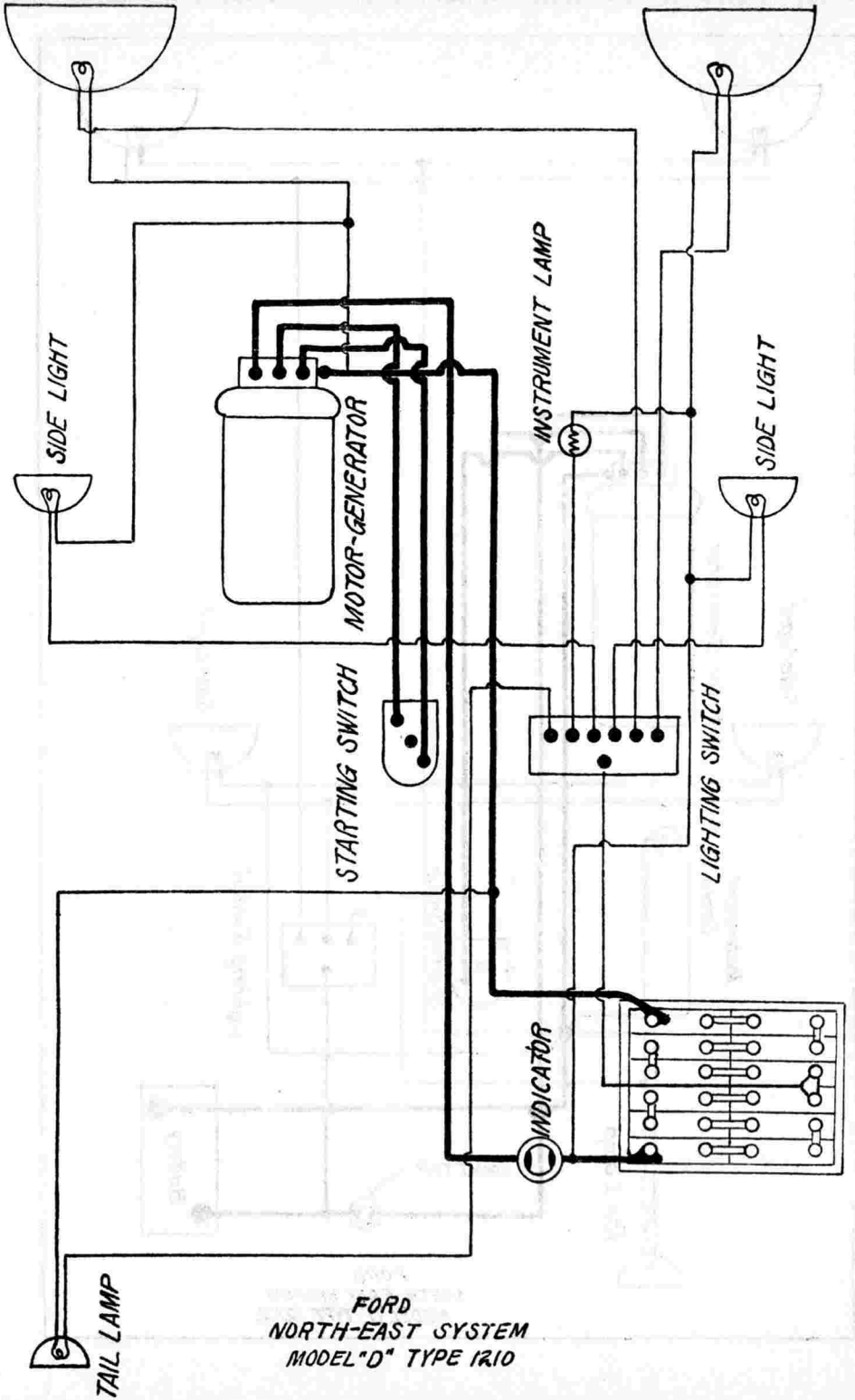
Generator.—Generator current regulation is by a vibrator regulator. The normal maximum output should be 6 amperes.

Relay-Regulator.—Relay is combined with regulator. Relay should close at 9-10 miles per hour. Charging current should be 3 amperes at closing, and the discharge current 0 to 1 amperes at opening of relay. The air gap between regulator coil core and armature should be .025 inch. Generator output may be increased by increasing the spring tension on regulator armature, or decreased by decreasing the spring tension. Clean relay-regulator contacts by drawing a piece of unglazed paper between them. If badly burned or pitted, resurface them with a piece of well worn No. 00 sand paper, drawing a piece of unglazed paper between them to remove all grit. Adjust before again putting into service.

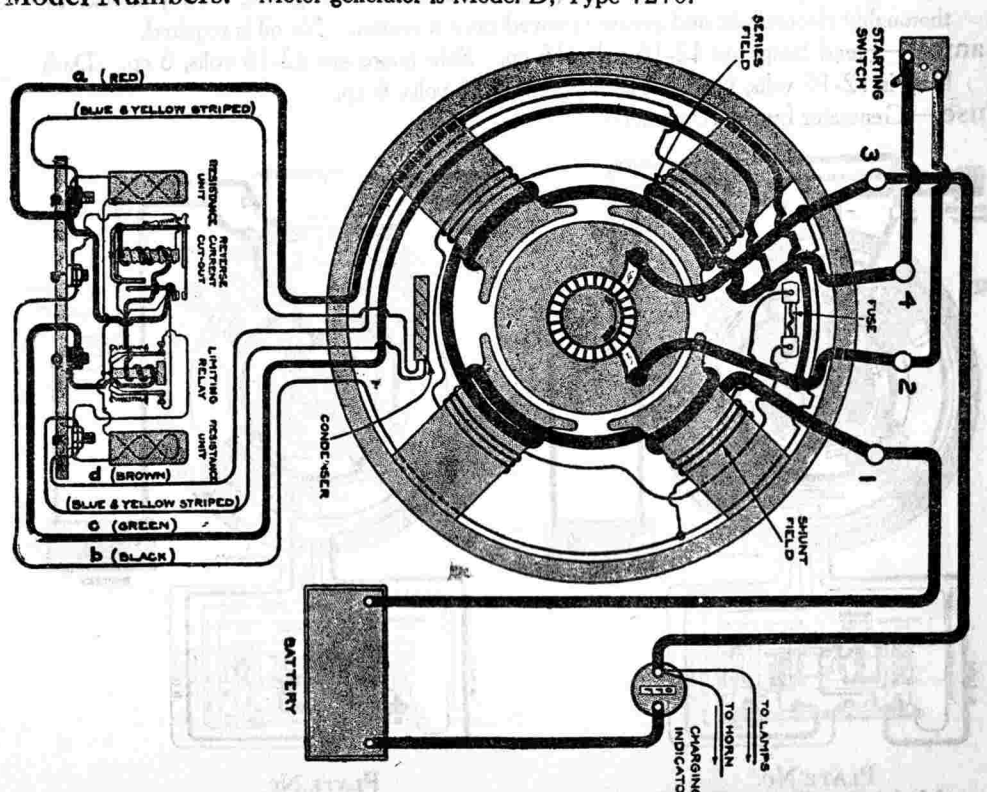
Lamps.—Head lamps are 12-16 volts, 18 cp. Side lamps are 12-16 volts, 4 cp. Dash lamp is 12-16 volts, 2 cp. Tail lamp is 12-16 volts, 4 cp.

Fuse.—Generator fuse is 10 ampere.

Model Numbers.—Motor-generator is Model D, Type 1210.



FORD
NORTH-EAST SYSTEM
MODEL "D" TYPE 1210



PLATE

Ford

North East Starting and Lighting System

Battery.—Battery is 12 volt, 50 ampere-hour. The two wire system is used.

Starter-Generator.—The motor and generator are combined into one unit. Armature is chain connected to the crank shaft. Cold engine, heavy oil, tight bearings or other obstructions, or damp, grounded or short circuited armature windings or commutator bars will cause high current and low speed during the cranking operation. Discharged, dry or sulphated battery, defective battery connections, defective switch contacts, defective starter connections, dirty commutator, high mica, dirty or sticking brushes, defective connections between armature coils and commutator bars or open circuits are the chief causes of low speed and low current. Starter should deliver 35 foot-pounds torque, taking 210 amperes.

Generator.—Generator current regulation is by reverse series field and vibrating regulator. Relay is in same case as regulator. Relay should close at 1000 R. P. M. of generator armature. Charging current should be 3 to 4 amperes at closing and the discharge current 0 to 1 ampere at opening of relay contacts. Relay air gap should be .030 inch. Regulator air gap should be .025 inch. The generator output should be 7 amperes. Increasing the spring tension on regulator armature (moving member) will increase the output. Decreasing the tension will decrease the output. Clean relay and regulator contacts by drawing a piece of unglazed paper between them. If badly burned resurface them with a piece of well worn No. 00 sandpaper, drawing a picee of unglazed paper between them to remove all grit, and adjust before again putting into service.

Oiling.—Motor-generator bearings are packed with soft cup grease. They should be thoroughly cleaned out and grease renewed once a season. No oil is required.

Lamps.—Head lamps are 12-16 volts, 16 cp. Side lamps are 12-16 volts, 6 cp. Dash lamp is 12-16 volts, 6 cp. Tail lamp is 12-16 volts, 6 cp.

Fuse.—Generator fuse is 10 mpaeres.

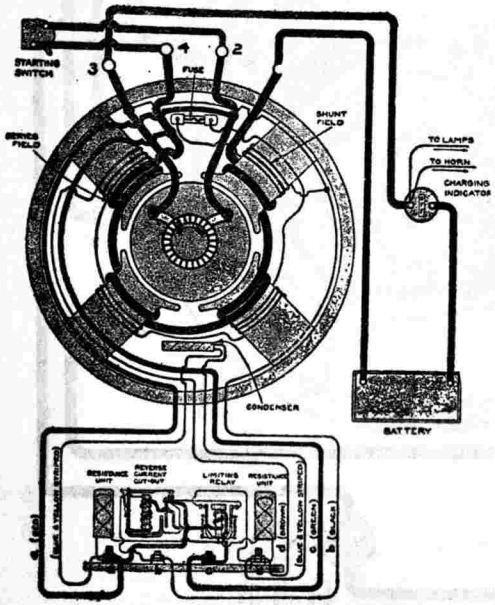


PLATE NO.
Model D. Binding Post Type
Starter-Generator

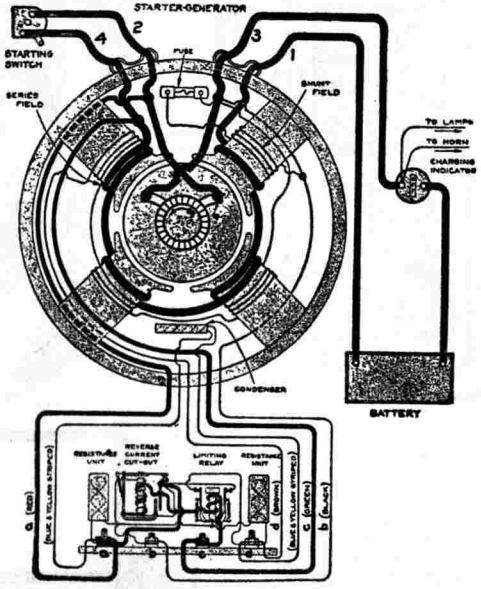
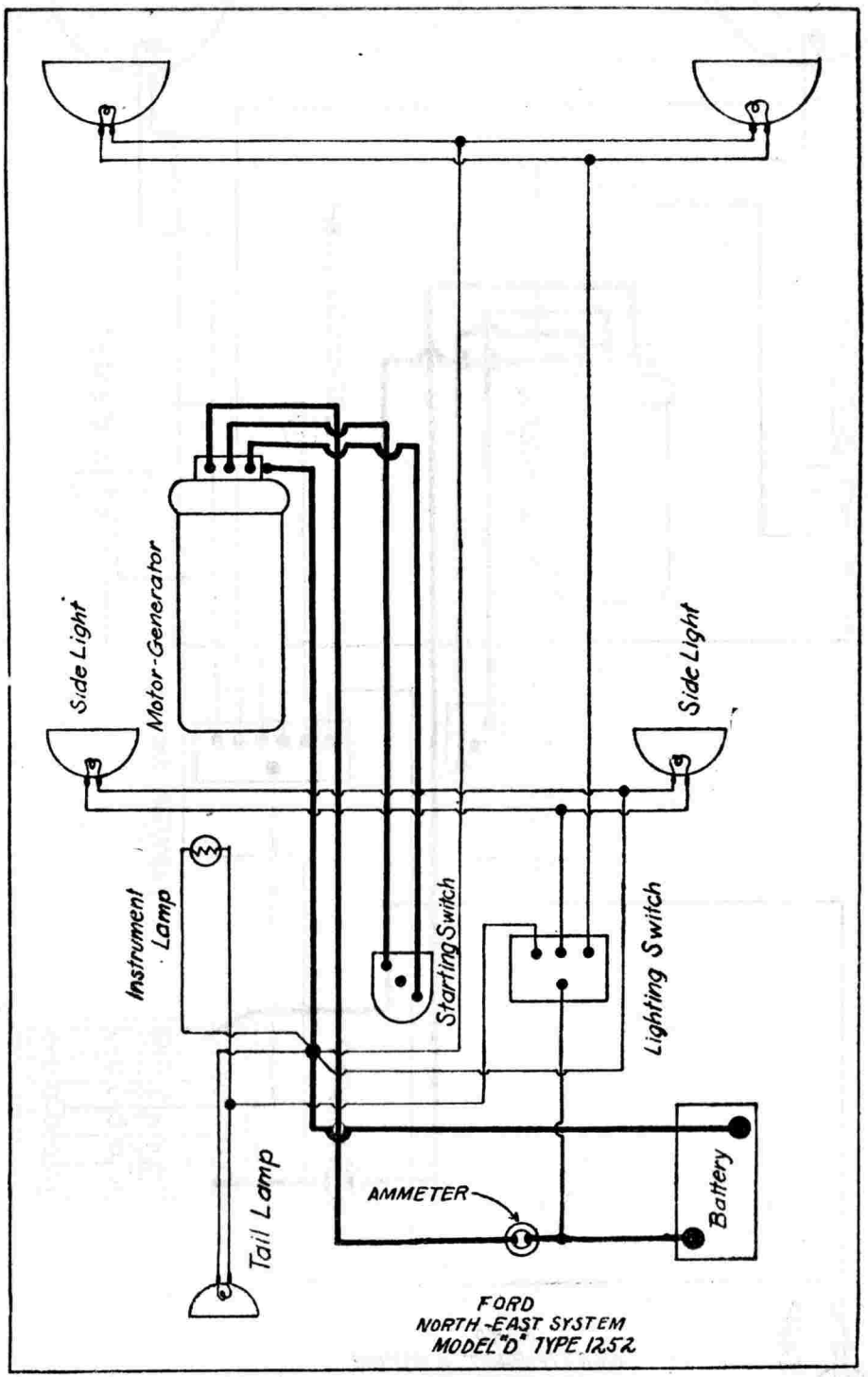


PLATE NO.
Model B. Flexible Lead Type
Starter-Generator



REMY MAGNETO

TYPE RL, LOW TENSION, INDUCTOR TYPE

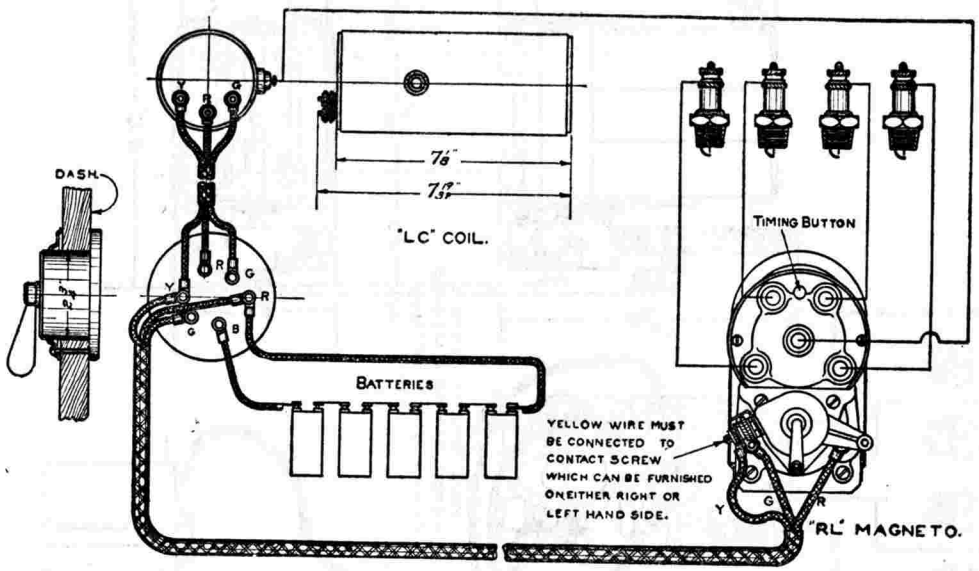
ROTATION.—Direction in which magneto must be driven is indicated by an arrow at drive end.

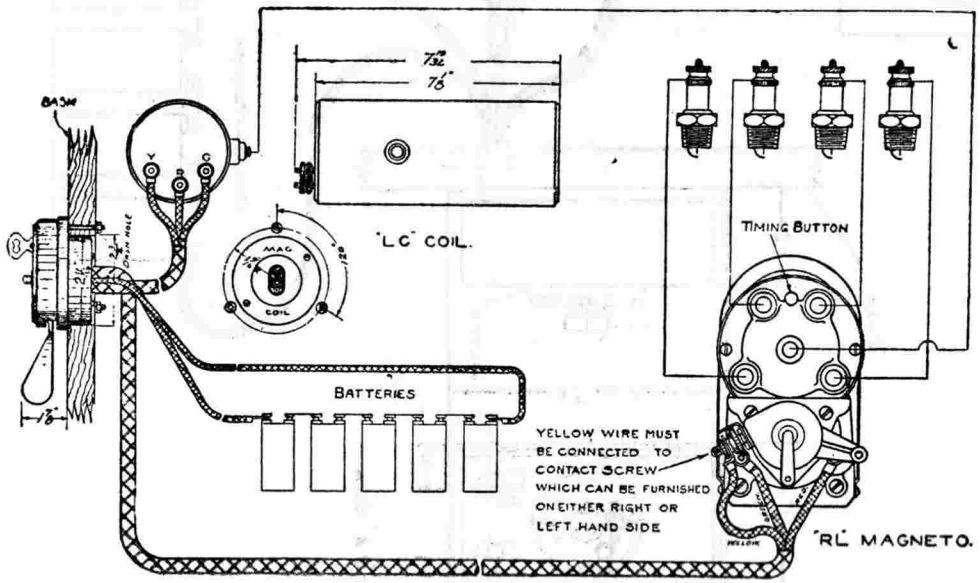
BREAKER.—Breaker contacts separate .020 to .025. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

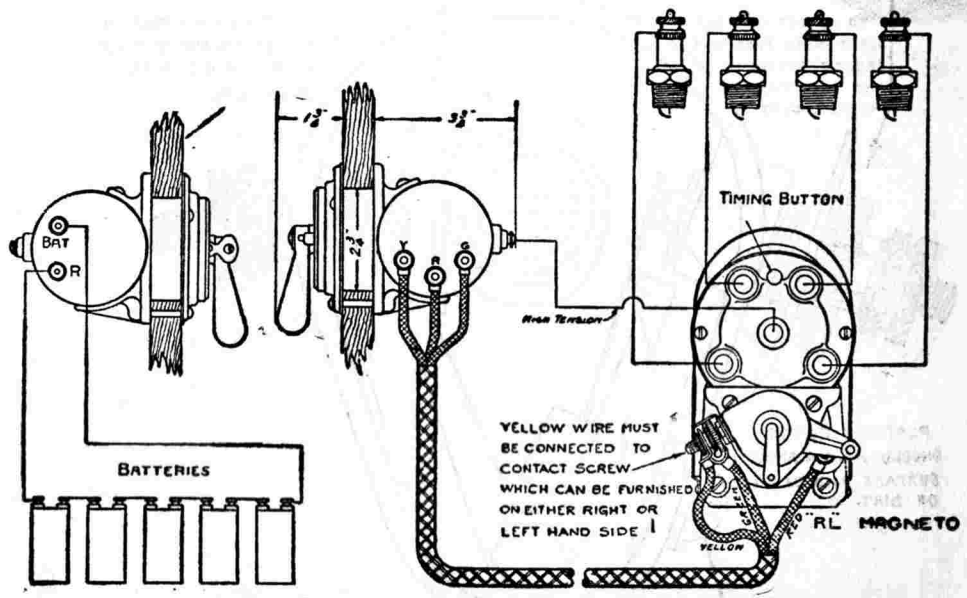
OILING.—Put 3 or 4 drops of light engine oil in each of the magneto oilers every month. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the spark is desired to occur. Press in the timing button at the top of the distributor block and turn the magneto shaft until the plunger of the button drops into the hole in the distributor gear. With the breaker box fully retarded, the contacts will be just separating when the armature is in this position. Couple the magneto to the engine, being careful not to disturb the relative position between the armature shaft and the driving member. Wire terminal No. 1 on the distributor to plug No. 1, and the other plugs in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .020 to .025 inch.







"LE" Switch & Coil

TYPES L, S, AND T. LOW TENSION, DUAL

ROTATION.—Magneto may be driven in either direction, without change or adjustment.

BREAKER.—The make-and-break lever and flat spring separate .031 inch when the cam is in the position shown in Plate 196A. If the ignition is at fault and the engine misses at slow speed, with the spark control retarded, turn the breaker contact adjusting screw to the left one-quarter turn or more. If the engine misses at high speed with the spark control advanced, turn the adjusting screw to the right, one-quarter turn or more. Resurface breaker contacts with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 3 or 4 drops of light engine oil in each of the four oilers every month. Put 2 or 3 drops of oil on the breaker cam. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Remove distributor plate. The distributor segment on the Types S and T Magnetos have two arrows marked upon it, one for each direction of rotation. The segment on the Type L magneto has one arrow mark. To change direction of rotation turn the segment over. Turn the magneto shaft until the arrow on the segment registers with the terminal point which is to be wired to the plug in No. 1 cylinder. With the armature in this position and the breaker housing fully retarded, the breaker contacts should just be separating. Couple the magneto to the engine, being careful not to disturb the relative position between the armature shaft and driving member. Connect the distributor terminals and plugs in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .025 to .030 inch.

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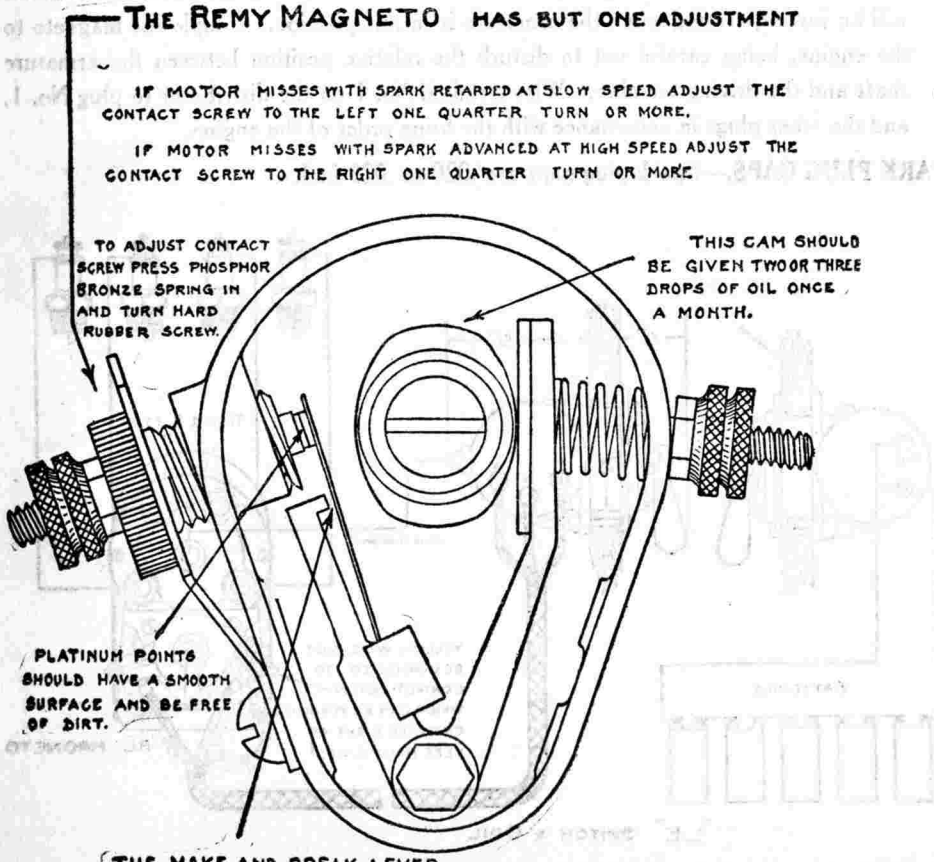
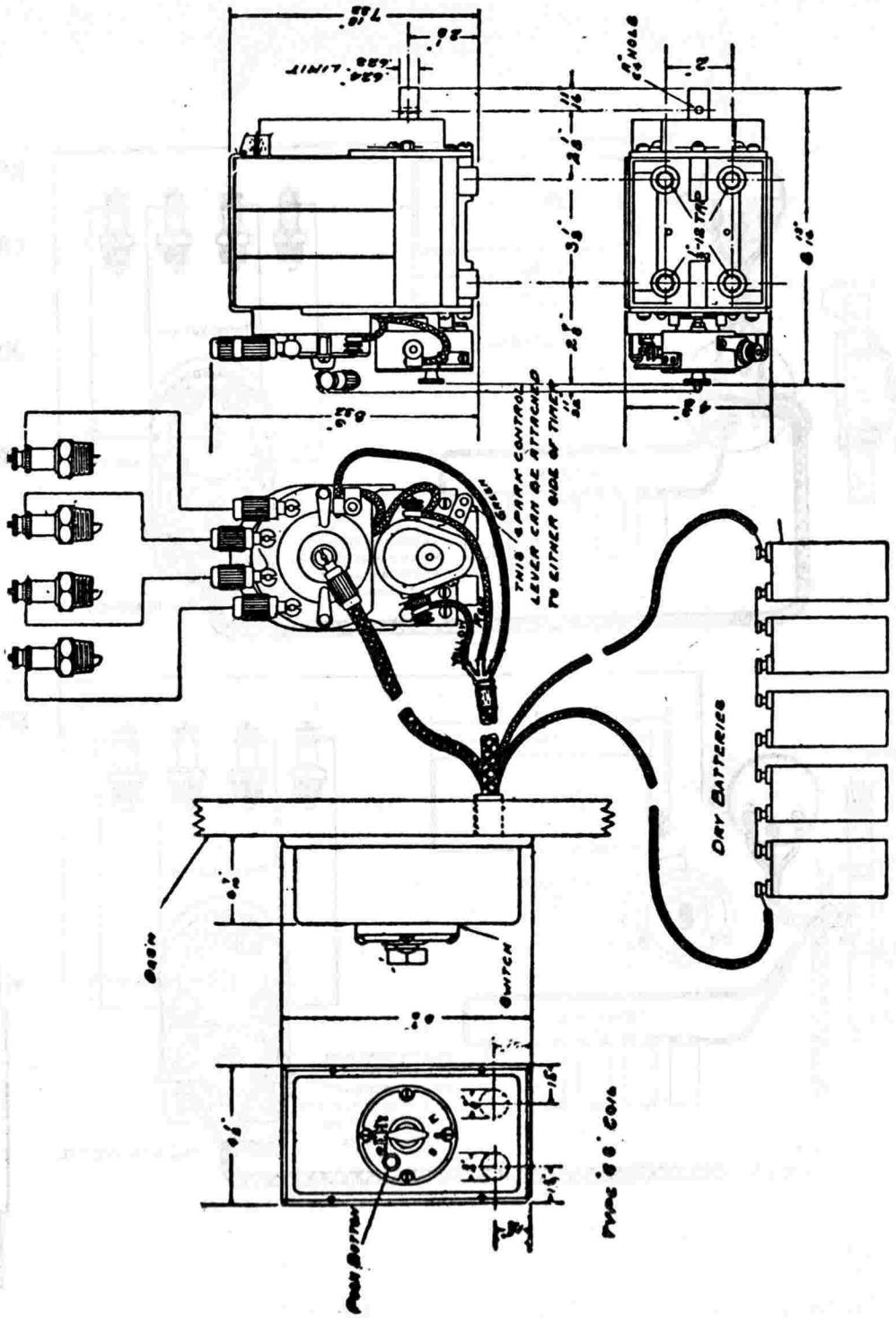
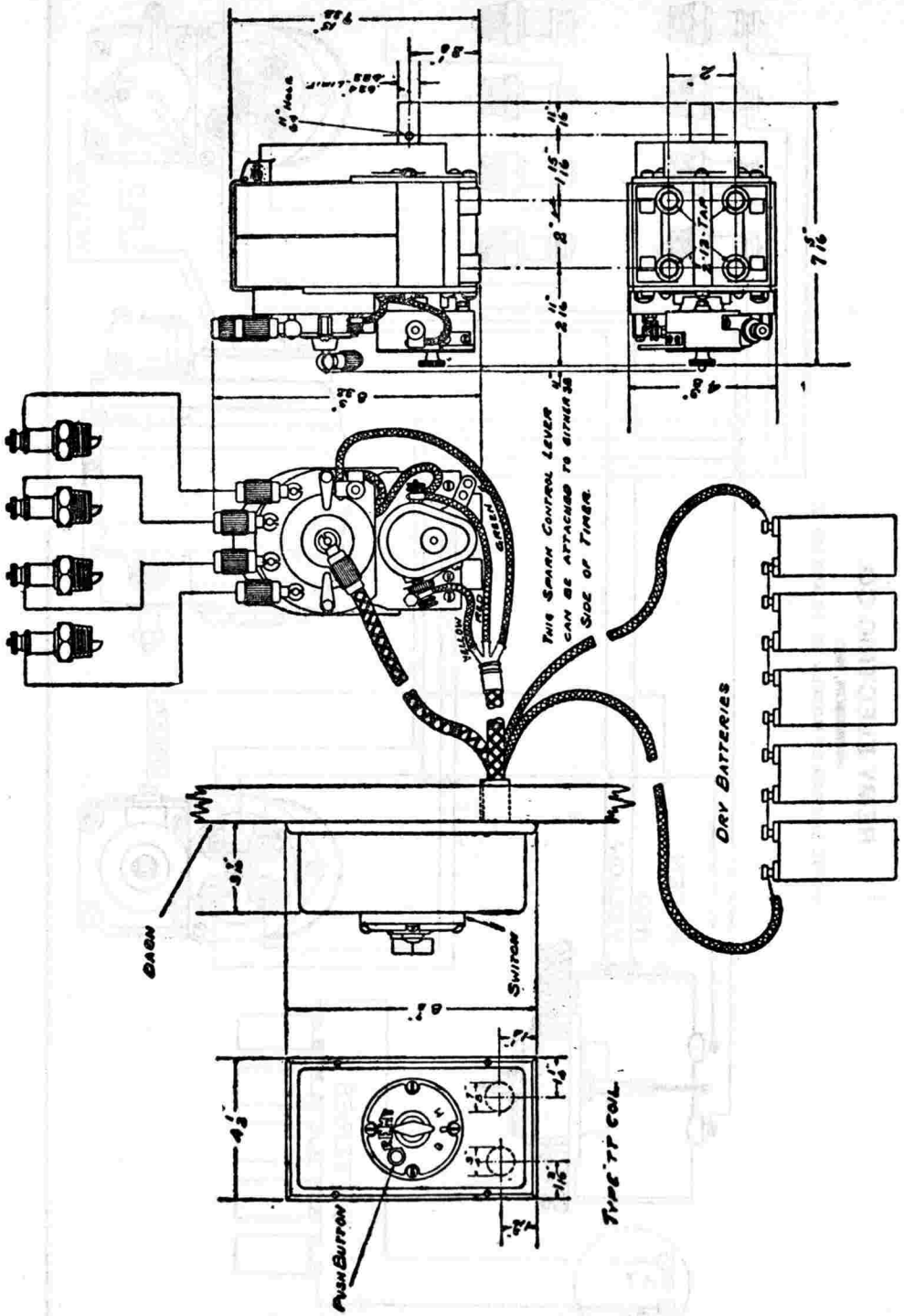




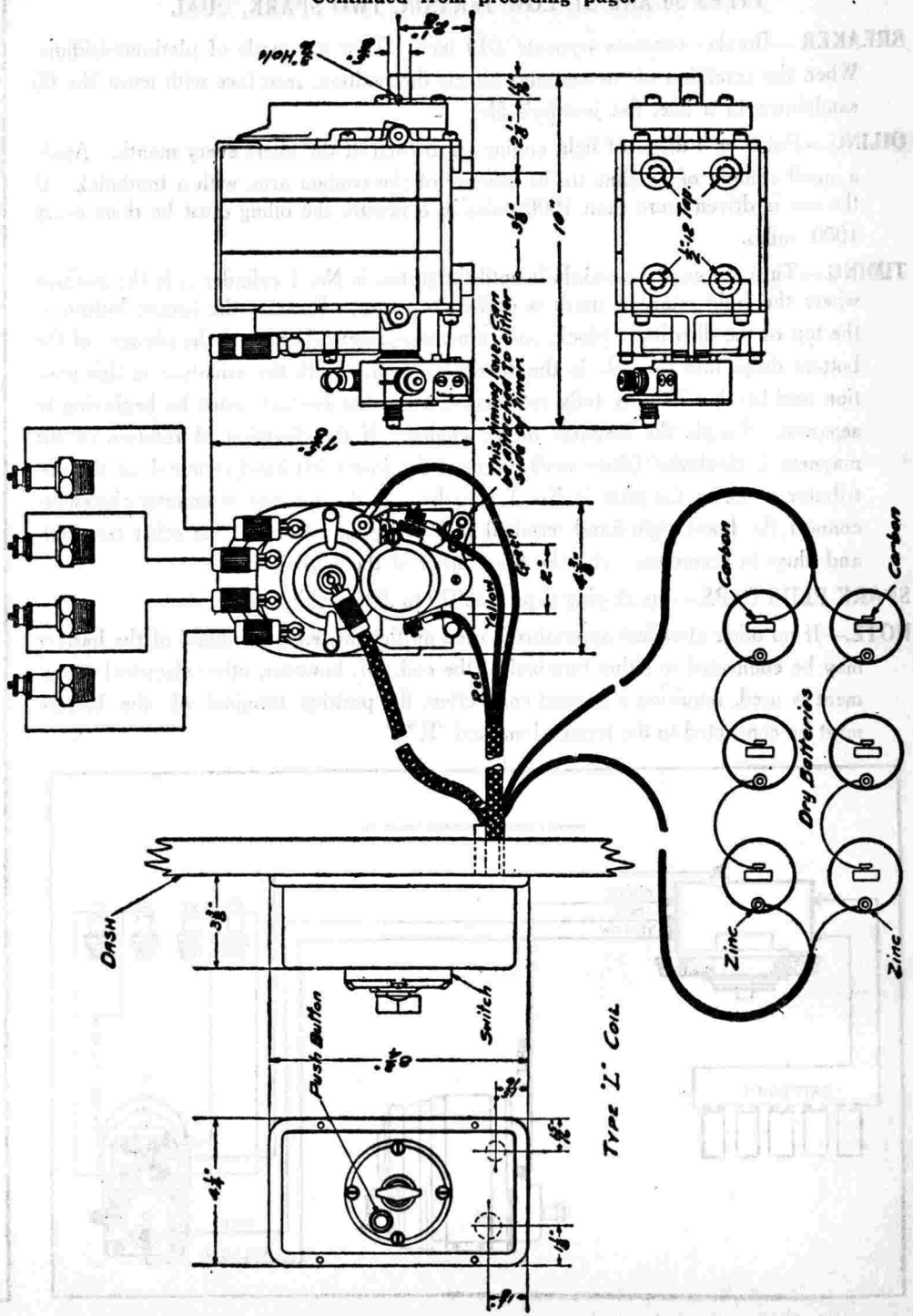
REMY MAGNETO

TYPES S AND L. LOW TENSION, DUAL

Continued from preceding page.



Type S.



REMY MAGNETO

TYPES P AND 32, LOW TENSION, SINGLE-SPARK, DUAL
TYPES 30 AND 31, LOW TENSION, TWO SPARK, DUAL

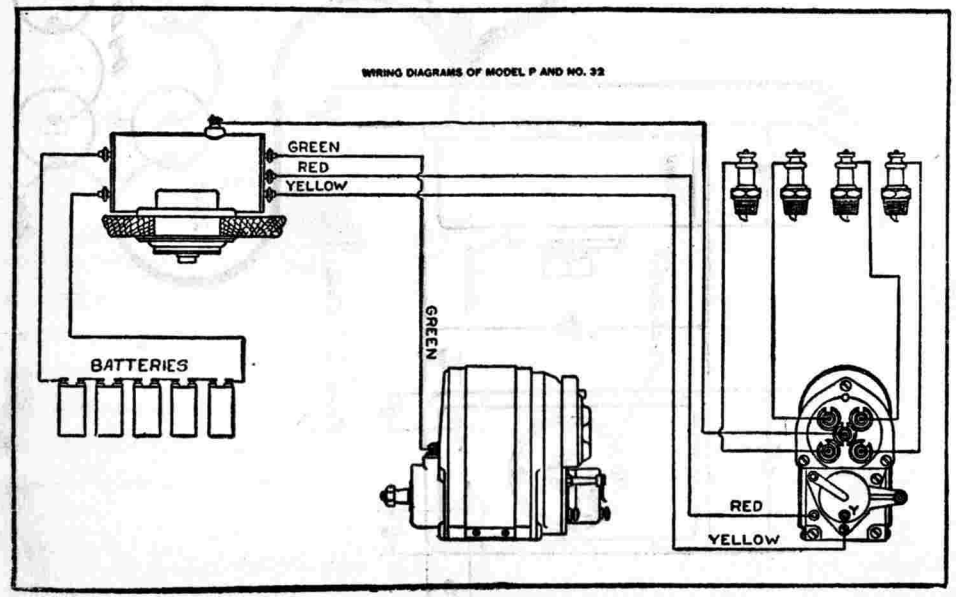
BREAKER.—Breaker contacts separate .015 inch. They are made of platinum-iridium. When the condition of the contacts affects the ignition, resurface with worn No. 00 sandpaper, or a fine, flat jeweler's file.

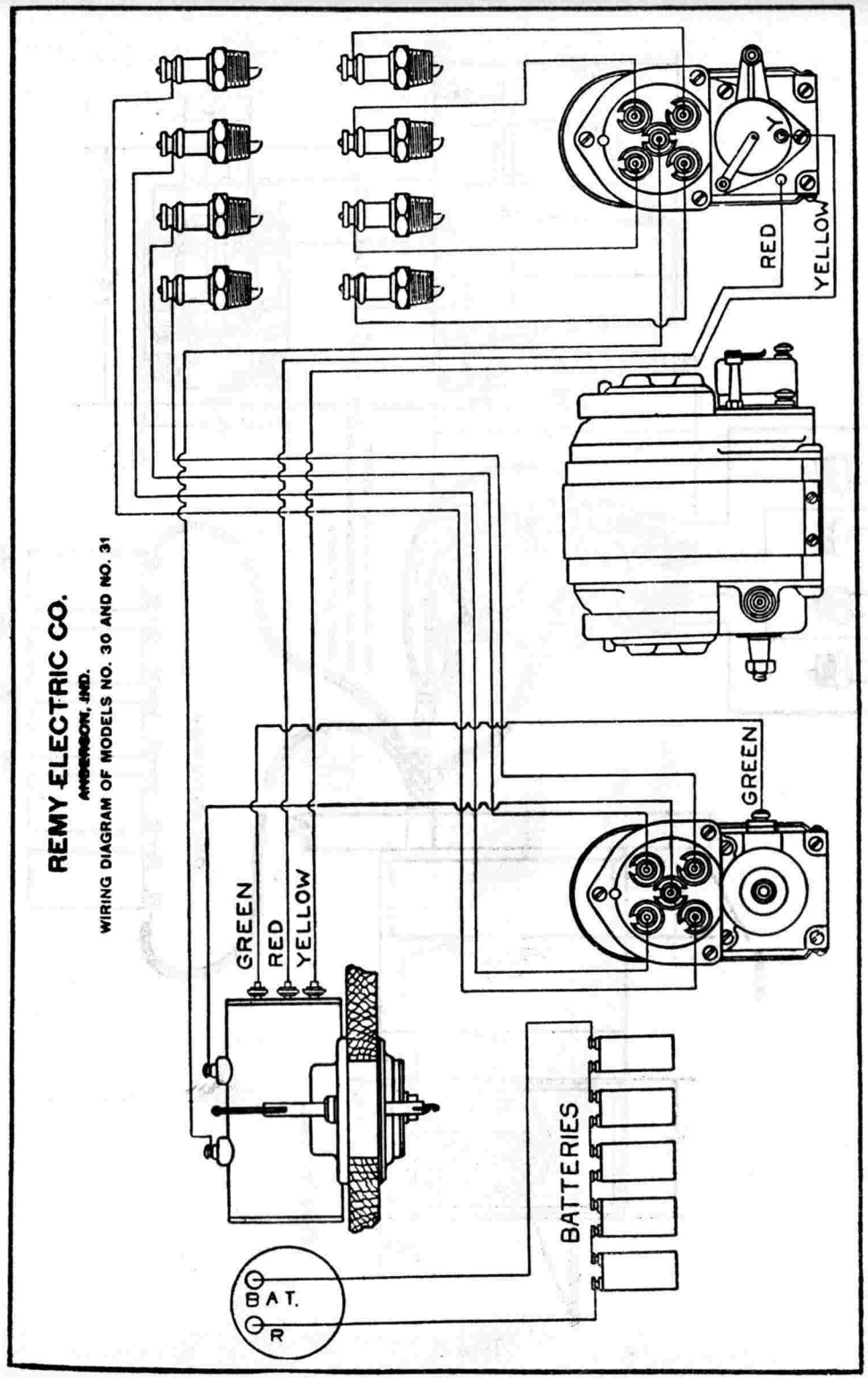
OILING.—Put 3 or 4 drops of light engine oil in each of the oilers every month. Apply a small amount of vaseline to the bumper of the contact arm, with a toothpick. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

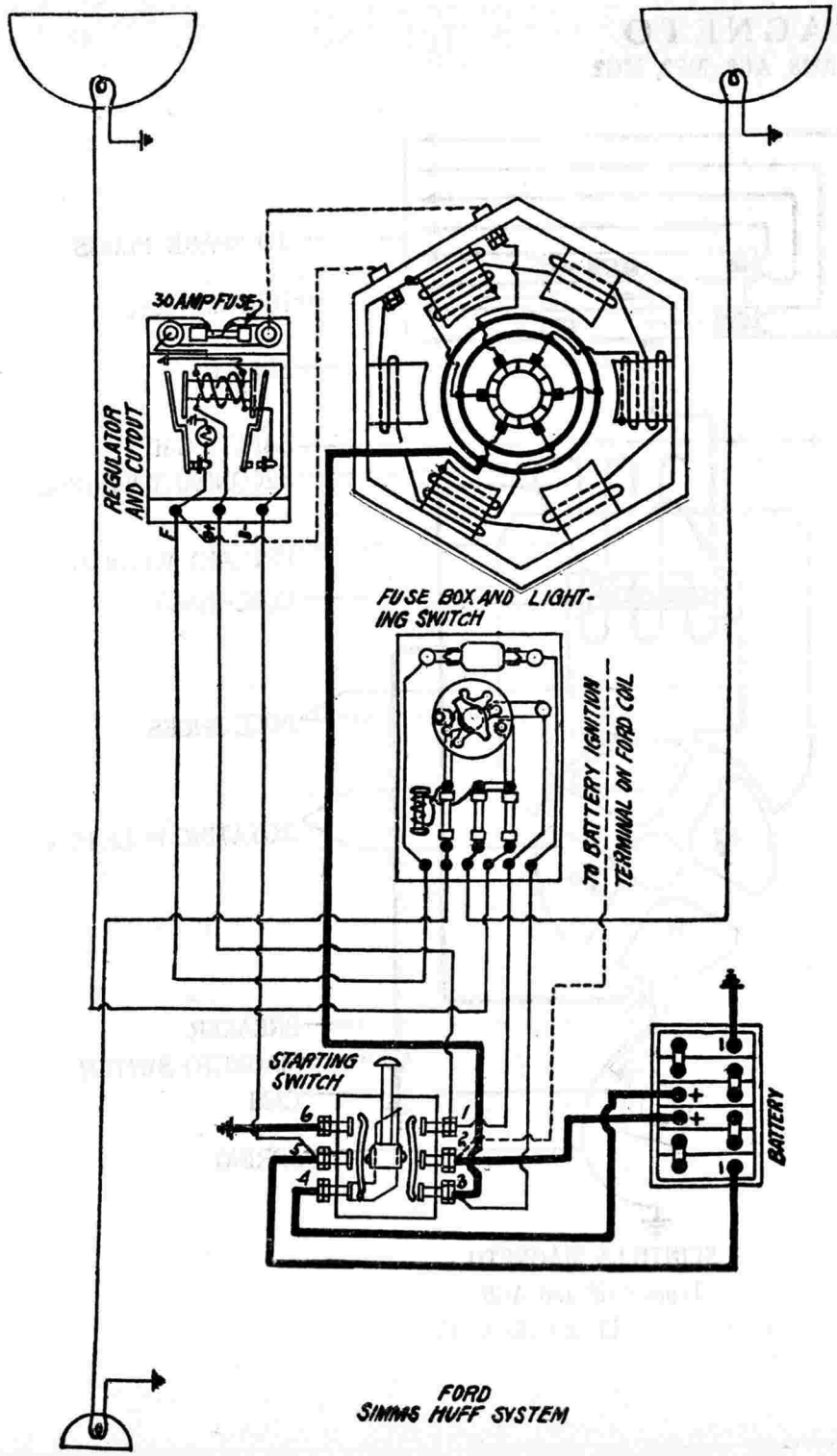
TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired tc occur. Press in the timing button at the top of the distributor block, and turn the magneto shaft until the plunger of the bottom drops into the hole in the distributor gear. With the armature in this position and breaker housing fully retarded, the breaker contacts must be beginning to separate. Couple the magneto to the engine. If the direction of rotation of the magneto is clockwise (drive end), connect the lower left-hand terminal on the distributor block to the plug in No. 1 cylinder. If the rotation is counter-clockwise, connect the lower right-hand terminal to No. 1 plug. Connect the other terminal and plugs in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .020 to .030 inch.

NOTE.—If no other electrical apparatus is used on the car, either terminal of the battery may be connected to either terminal of the coil. If, however, other electrical equip ment is used, requiring a ground connection, the positive terminal of the battery must be connected to the terminal marked "R".







FORD
SIMMS HUFF SYSTEM

Ford

Simms-Huff System

Battery.—Battery is 12 volt, 35 ampere-hour. The negative (—) terminal of one set of 3 cells is grounded.

Starter-Generator.—Starter and generator are combined to form a single unit. The starter operates at 12 volts and the generator at 6 volts. Depressing the starting pedal connects the two halves of the battery in series for starting. When pedal is released, the two halves are connected in parallel for charging. Starter should deliver 24 pound-feet lock torque. The shunt and series fields work together, producing increased torque when operating as a motor, and against each other, limiting the current, when operating as a generator. There are three series coils wound on alternate poles, each grounded at its inner end.

Generator.—Generator current regulation is by combined vibrating regulator and reverse series field. Maximum rate should be 10-15 amperes, reached at 16-18 miles per hour. Charging rate should be 12 amperes, armature turning at 1200 R. P. M. On generators below serial No. 27,000, the resistance of the shunt field circuit is 6.5 ohms, and on machines having serial numbers above 27,000, it is 4.8 ohms. When operating freely as a motor, generator should take 7 amperes at 6 volts pressure. Excessive current indicates damp, grounded or short circuited windings, tight bearings or armature striking pole pieces. Less current indicates defective connecting, dirty brushes, dirty commutator or high mica.

Oiling.—Put several drops of light engine oil in each of the motor-generator oilers every two weeks. If car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

Relay-Regulator.—Relay and regulator are combined into one unit. Relay should close when the generator voltage reaches 14 volts. Two carbon contacts operate in parallel with the main contacts which are of copper. It is important that the copper contacts separate before and close after the carbon contacts, so that no arcing can take place at the former. If they do not, sticking of the relay or failure to open will result. Generator output may be increased by increasing spring tension of regulator armature (moving member), and decreased by decreasing tension. If output continues to increase above 15 amperes as speed increases, regular contacts are not opening as they should. In this case spring tension should be decreased and regulator contacts should be cleaned by drawing a piece of unglazed paper between them.

Lamps.—Head lamps are 6-8 volts, 18-21 cp. Tail lamps are 6-8 volts, 2 cp.

SCINTILLA MAGNETO

TYPES AM4, AG4, AM6, AG6, AM8, AG8, MP2, MG2

ROTATION.—The direction in which the magneto operates is indicated by an arrow on the magneto cover.

BREAKER.—The contact points are made of platinum-iridium and separate .013 inch. The complete breaker assembly may be removed by hand for cleaning and inspection. The contact points seldom require resurfacing, but if their condition affects the ignition, they should be resurfaced with a fine, flat jeweler's file.

OILING.—Put 5 or 6 drops of light engine oil in the two oil wells every 500 miles.

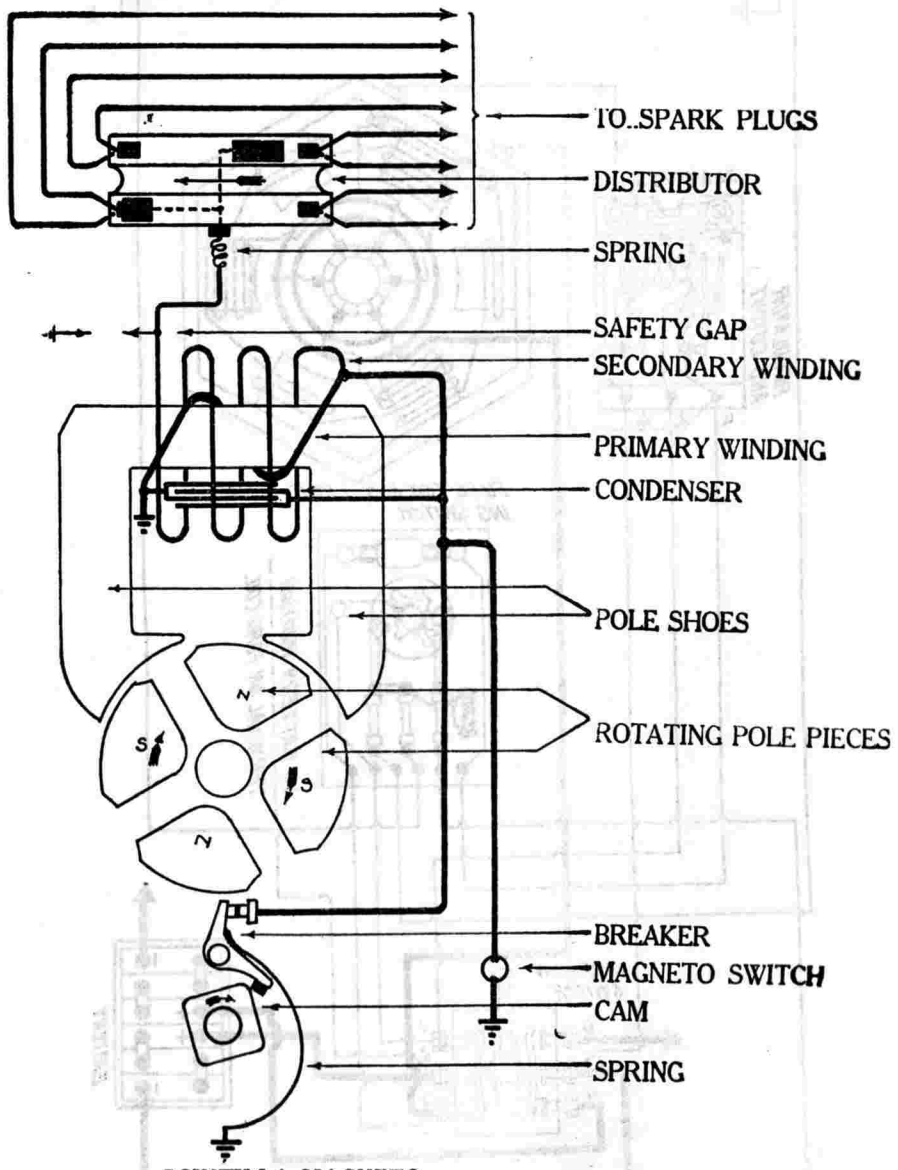
TIMING.—1st. When the maximum advance of the magneto is known:

Turn the engine over until the piston in Number 1 cylinder is in the position where the fully advanced spark should occur. Then turn the magneto shaft until Number 1 on the distributor gear wheel corresponds with the index in the timing window in the front end plate. At this moment the contact points begin to separate, provided the advance lever is set at full advance (opposite to the direction in which the magneto rotates). Contact is then made between the corresponding segment on the distributor cylinder and terminal Number 1 on the distributor carbon brush holder.

2nd. When the maximum advance of the magneto is not known:

Turn the engine over until the piston in Number 1 cylinder is on top dead center. Set the advance lever at full retard (in the same direction in which the magneto rotates), and turn the magneto shaft until Number 1 on the distributor gear wheel has passed the timing window and the contact points just begin to open. To see the breaker points, remove the contact breaker cover by releasing the two spring clamps. Tighten the coupling and fasten the magneto securely to the base. Connect terminal Number 1 to the spark plug in cyinder Number 1. Then follow the firing order of the magneto as marked on the distributor carbon brush holders, that is: 1, 2, 3, 4, 5, 6, 7, 8, and connect the cables to the spark plugs in accordance with the firing order of the engine.

SPARK PLUG GAPS.—The spark plug gaps should be .020 inch.



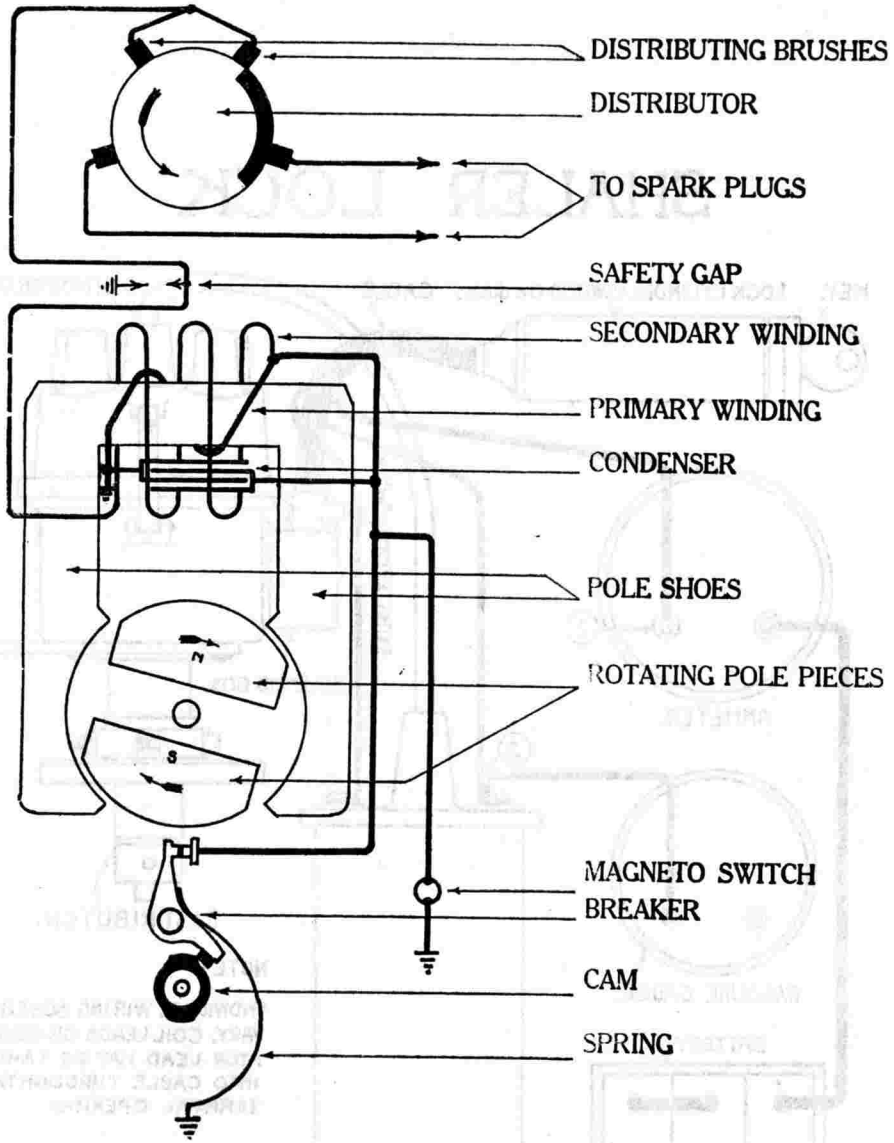
SCINTILLA MAGNETO

Types AM8 and AG8

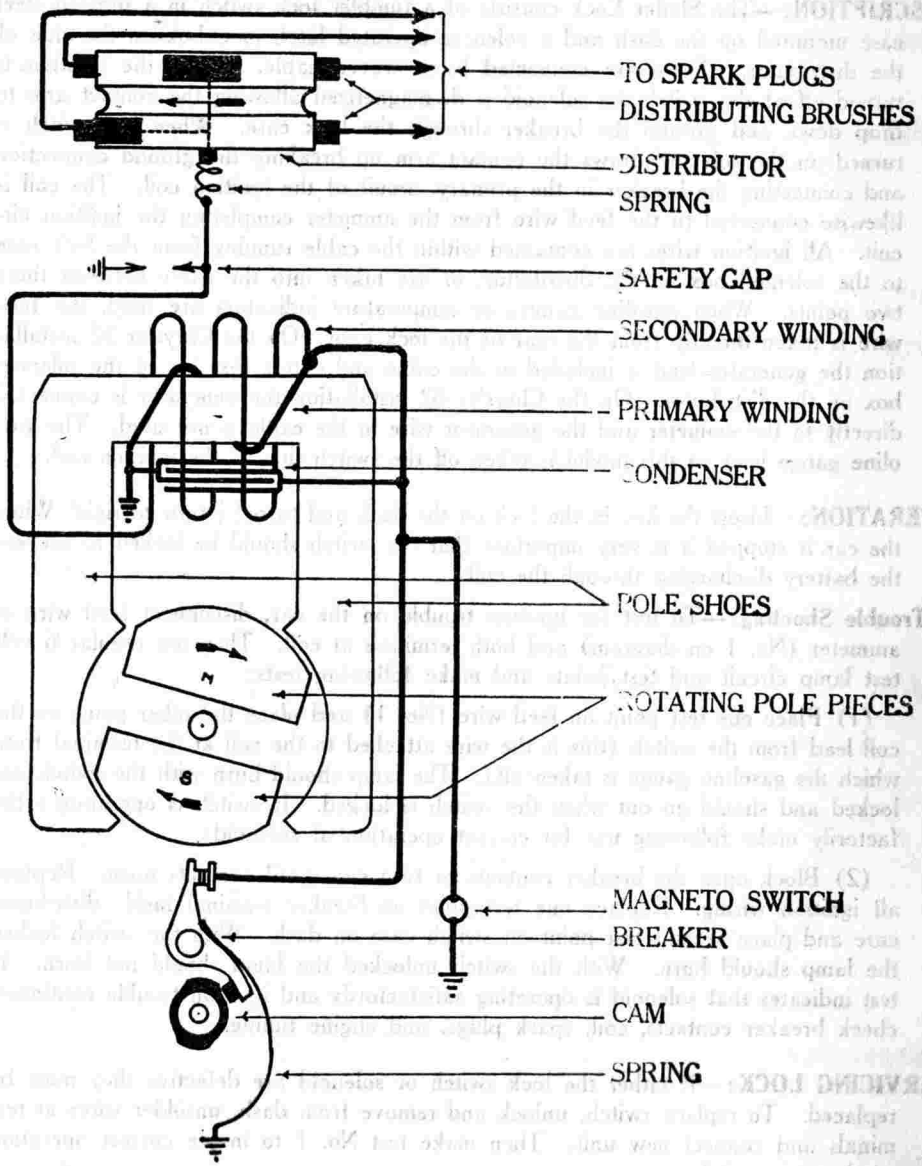
Type Used on Eight Cylinder Cars

SCINTILLA MAGNETO

MP2, MG2, AM4, AG4, AM6, AG6



SCINTILLA MAGNETO
Types MP2 and MG2
Type Used on Two Cylinder Engines



SCINTILLA MAGNETO
Types AM4, AG4, AM6 and AG6
Types Used on Four and Six Cylinder Engines
The Six Cylinder Type Uses Six Distributor Brushes
Instead of Four, as Shown Here

SHALER LOCK

DESCRIPTION:—The Shaler Lock consists of a tumbler lock switch in a pressed steel case mounted on the dash and a solenoid operated latch in a box on the side of the distributor. These are connected by a woven cable. When the ignition is turned off at the switch the solenoid is de-magnetized allowing the contact arm to drop down and ground the breaker through the lock case. When the switch is turned on the solenoid draws the contact arm up breaking the ground connection and connecting the breaker in the primary circuit of the ignition coil. The coil is likewise connected to the feed wire from the ammeter completing the ignition circuit. All ignition wires are contained within the cable running from the lock case to the solenoid box on the distributor, or are taken into the cable between these two points. When gasoline gauges or temperature indicators are used, the feed wire is taken directly from the rear of the lock case. On the Chrysler 52 installation the generator lead is included in the cable and enters the side of the solenoid box on the distributor. On the Chrysler 62 installation the generator is connected directly to the ammeter and the generator wire in the cable is not used. The gasoline gauge lead on this model is taken off the switch side of the ignition coil.

OPERATION:—Insert the key in the lock on the dash and turn ¼ turn to right. When the car is stopped it is very important that the switch should be locked to prevent the battery discharging through the coil.

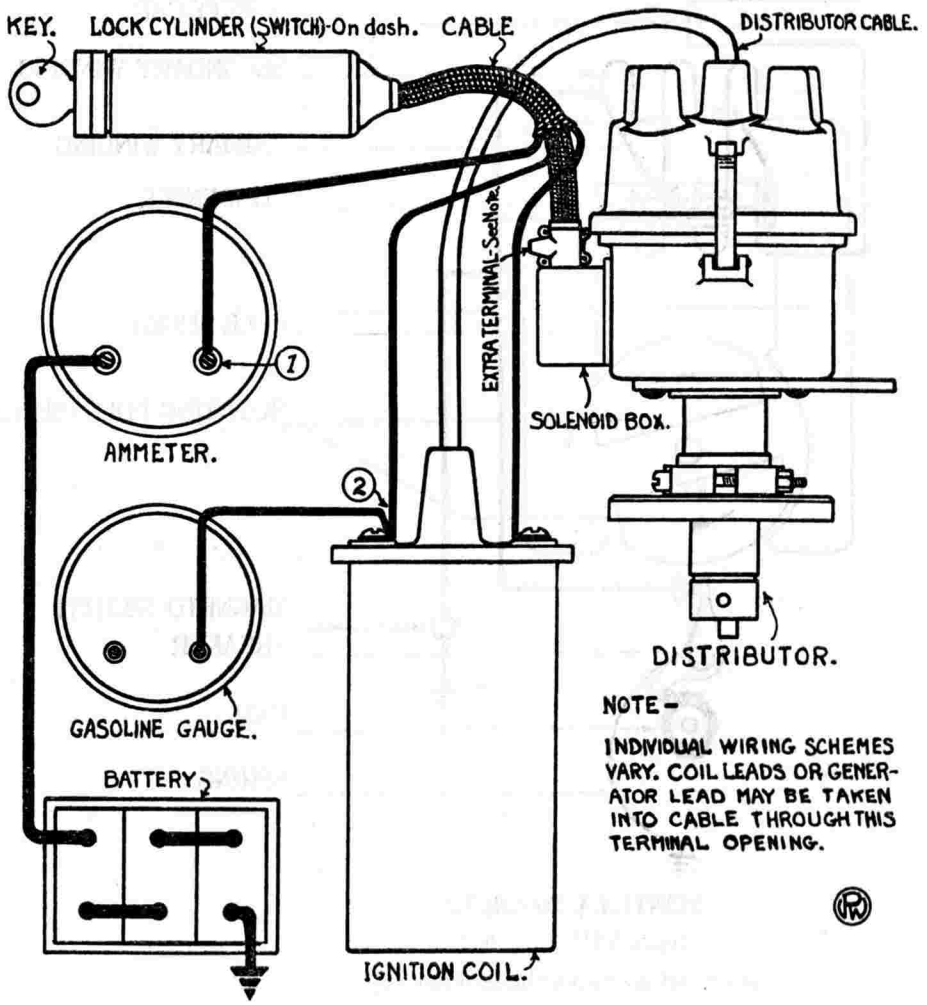
Trouble Shooting:—To test for ignition trouble on the car, disconnect feed wire at ammeter (No. 1 on diagram) and both terminals at coil. Then use regular 6 volt test lamp circuit and test points and make following tests:

(1) Place one test point on feed wire (No. 1) and place the other point on the coil lead from the switch (this is the wire attached to the coil at the terminal from which the gasoline gauge is taken off). The lamp should burn with the switch unlocked and should go out when the switch is locked. If switch is operating satisfactorily make following test for correct operation of solenoid:

(2) Block open the breaker contacts or turn cam until contacts open. Replace all ignition wiring. Replace one test point on breaker terminal inside distributor case and place second test point on switch case on dash. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If test indicates that solenoid is operating satisfactorily and ignition trouble continues, check breaker contacts, coil, spark plugs, and engine timing.

SERVICING LOCK:—If either the lock switch or solenoid are defective they must be replaced. To replace switch, unlock and remove from dash, unsolder wires at terminals and connect new unit. Then make test No. 1 to insure correct operation of the new switch.

To remove solenoid from breaker, take off distributor head, unsolder nut on terminal inside, remove nut, take off breaker arm spring and push stud out through case. In installing new unit make certain that the insulating washers are replaced in proper order so as to insulate stud from case. After testing to make certain that solenoid is operating satisfactorily, resolder nut, being careful not to use too much heat as this will draw out temper of breaker arm spring.



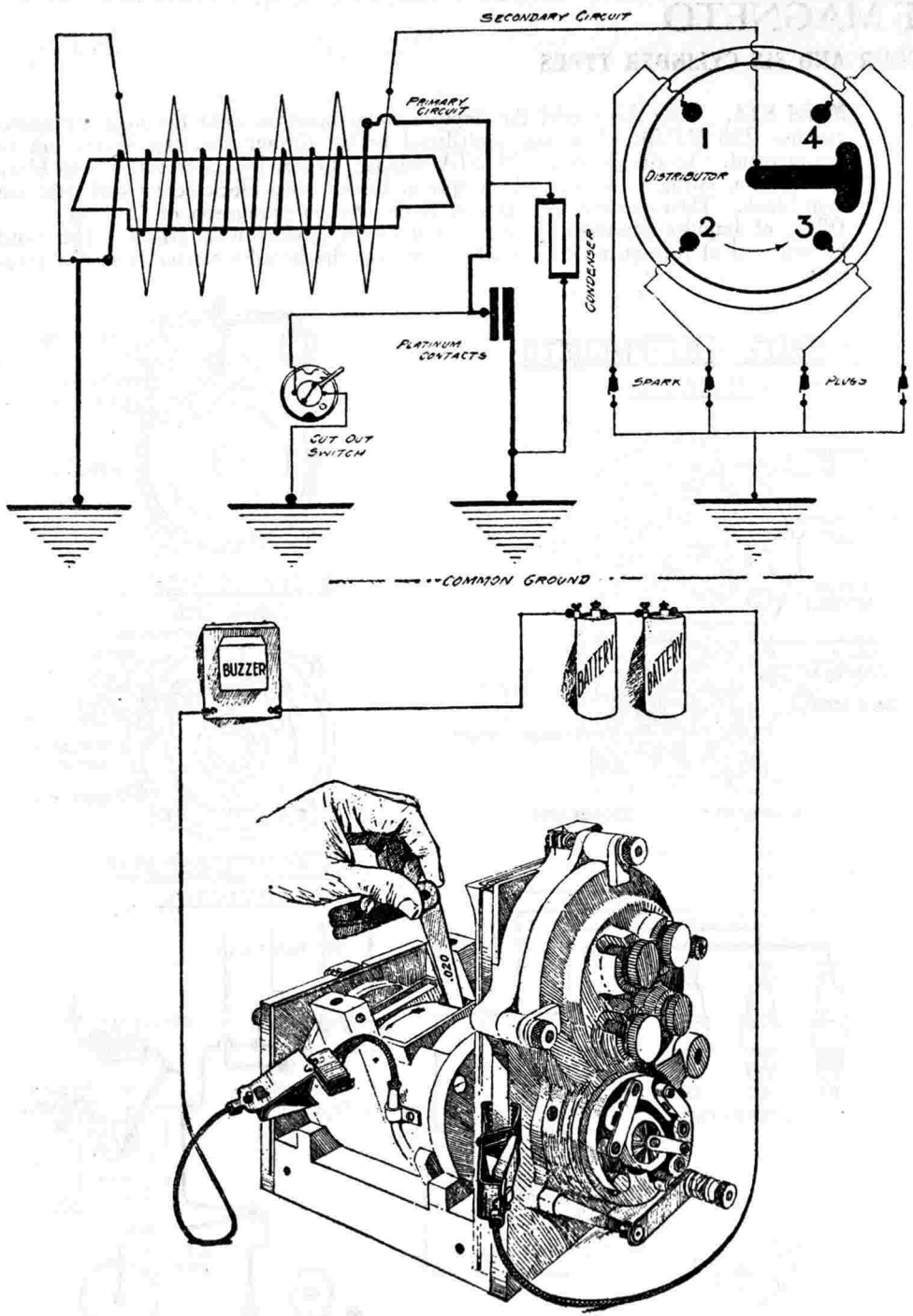


Fig. 2—Method of connecting buzzer to magneto primary circuit, for accurately setting the relation of contact opening, to rotor position.

SPLITDORF

DIXIE MAGNETO

OPERATION.—The Dixie magneto is of the inductor type. The coil, consisting of primary and secondary windings, is wound around a stationary, soft iron core. The permanent field has two movable pole pieces, which rotate past the ends of this core, thus reversing the direction of magnetism through the core and producing a high pressure by the same elementary process as in the ordinary shuttle-wound armature.

BREAKER.—Breaker contacts separate .020 inch. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper. To accurately set the action of the breaker in relation to the position of the armature, proceed as follows: Connect a buzzer in series with two dry cells and the breaker of the magneto as shown in Figure 2. Turn the armature shaft very slowly in the proper direction of rotation, until the buzzer ceases to buzz. This is an indication that the breaker contacts have separated. With the rotor in this position, the air gap between the edge of the rotor and the stationary core must be .015 to .035 inch. In case the air gap does not measure within the specified limits, the breaker base may be shifted within the bearing holder. Loosen the four holding screws which pass through the slotted holes in the breaker base. If the rotor gap is too small, move the breaker base in the same direction in which the cam rotates in operation. If the rotor gap is too large, move the breaker base in the opposite direction to that which the cam rotates. When the proper adjustment has been secured, tighten the four holding screws.

OILING.—Fill the oil cups with light engine oil every month. Apply one drop of oil to the breaker bar bearing. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

TIMING.—Turn the engine crankshaft until the position in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Turn the magneto shaft in the direction in which it is to operate until the breaker contacts are just beginning to separate, with the breaker in the fully retarded position. Couple the magneto to the engine, being careful not to disturb the relative position between the armature shaft and driving member. Determine which distributor terminal is in contact with the distributor brush, and connect that terminal to the plug in No. 1 cylinder. Connect the other terminals and plugs in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .020 to .025 inch.

SPLITDORF MAGNETO

MODEL B-2, B-4, B-6. TWO, FOUR AND SIX CYLINDER TYPES

DESCRIPTION:—The Model B Splitdorf Magneto is of the inductor type. Primary and secondary windings are mounted on a 'U' shaped core and are mounted inside the arch of the magnets. They are stationary. The condenser is mounted directly above the winding. The rotor is of die-cast aluminum mounted on a steel shaft carried on ball bearings and has on its circumference four laminated steel members which complete the magnetic field between the pole pieces. Magneto is fitted with both 20° and 30° timing slots. The advance arm may be mounted in either a right, left or vertical position. Magneto is fitted with taper shaft for standard coupling. It should be driven at crankshaft speed on a four cylinder engine and 1½ crankshaft speed on a six cylinder engine.

BREAKER:—Breaker contacts separate .020 inch with contact arm fully depressed by cam. Resurface contacts when necessary with a fine flat contact file. If breaker contacts are badly worn they should be removed and replaced. Use Splitdorf Parts Nos. 63700 and 64503 for this purpose.

TIMING:—To set magneto for correct position of rotor when contacts open. To check magneto for correct assembly, fully advance spark control lever and connect a battery in series with a buzzer between the stationary contact and the magneto frame. The buzzer will operate while the contacts are closed. Then insert a .062 inch feeler gauge in the slot on the right side for clockwise drive and left side for counter-clockwise drive of the magneto frame (viewed from drive end). Rotate drive shaft in a direction opposite to direction of rotation until the feeler gauge is just gripped by the rear rotor segment. The buzzer should stop vibrating at this point indicating that the breaker contacts have opened.

To time magneto to engine. Crank engine until piston No. 1 reaches firing position. See manufacturer's recommendations as given in car data sheets. If these are not available the engine may be timed with piston No. 1 on top dead center entering power stroke. Remove distributor block and rotate magneto shaft until the keyway points directly upward. Fully retard spark control lever and continue to rotate shaft until contacts begin to separate. At this point the distributor finger will be approaching the lower left hand segment position. Couple magneto to engine being careful not to disturb relative positions of magneto shaft and crankshaft, Replace the magneto distributor block and connect the lower left hand segment to the spark plug in cylinder No. 1. Connect the remaining terminals to the spark plugs in the other cylinders in accordance with the firing order of the engine.

OILING:—Care must be taken not to over-oil the magneto. Every 200 hours of running, put 2 or 3 drops of light engine oil in the oiler at each end of the magnet dust cover plate. At the same time remove the breaker housing cover and put a few drops of oil in the wick oiler directly above the breaker arm pivot. The distributor block may be wiped out with a clean soft cloth moistened with gasoline but it should be wiped dry before assembling the block.

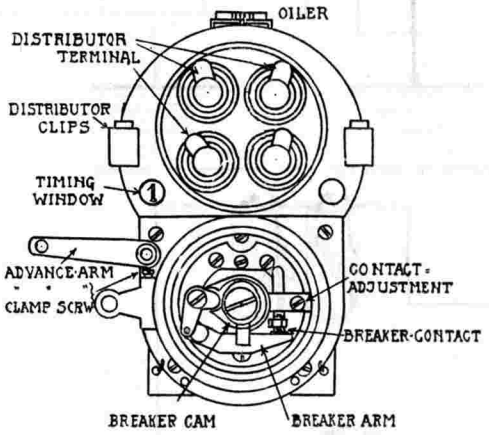
IMPULSE STARTERS:—The Model B magneto may be fitted with two types of impulse starters, the STM manual enclosed type and the STA automatic enclosed type. In each case the outer cam member serves as half the coupling to the engine.

Model STM. To operate this type impulse starter the trip lever 'G' must be thrown to the left hand position (viewed from the drive end). This places the starter in operation and causes the spring to rotate the magneto armature at a high rate of speed to produce a very intense spark. This action continues until the starter dog is thrown out of engagement with sufficient force to cause it to fall over dead center. The hand lever must then be operated to place impulse starter in action again.

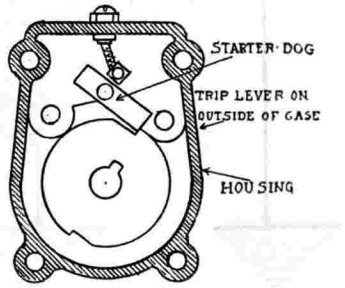
To time engines with magneto with Model STM impulse starter, throw starter dog out of engagement with hand lever in right position and then proceed with timing as directed in paragraph on 'Timing'.

Model STA. With this model the impulse stater operates until the magneto speed reaches 250 R.P.M. when the centrifugal action throws the stop levers out ot engagement. To time engine with STA impulse starter, loosen screw in stop block spring arm, swing aside stop block spring, loosen stop block screw and pull out stop block. Then proceed with timing as directed in paragraph on 'Timing'.

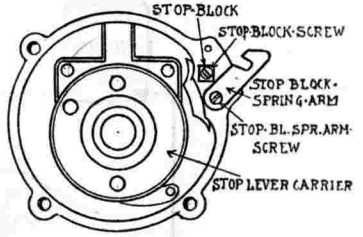
Oiling of Impulse Starters:—Impulse starters are packed with grease. This must be renewed at infrequent intervals by removing the impulse starter from the magneto.



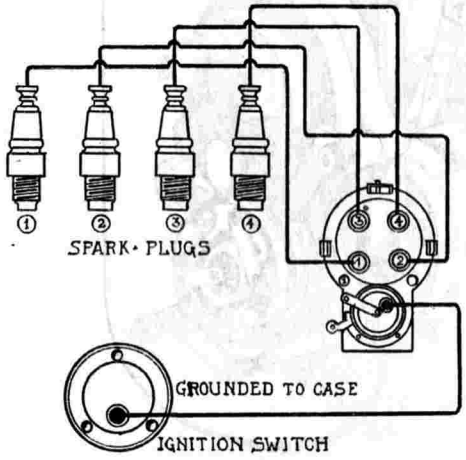
—SPLITDORF MAGNETO—
—MODEL B—



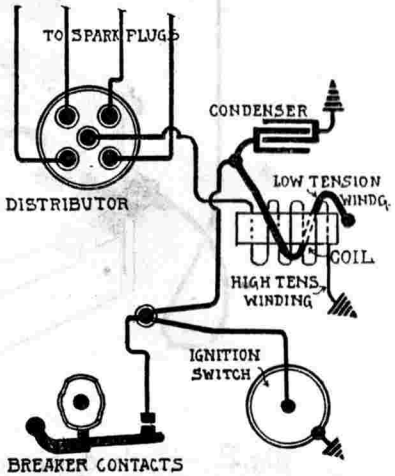
ST.M IMPULSE STARTER
MANUEL TYPE



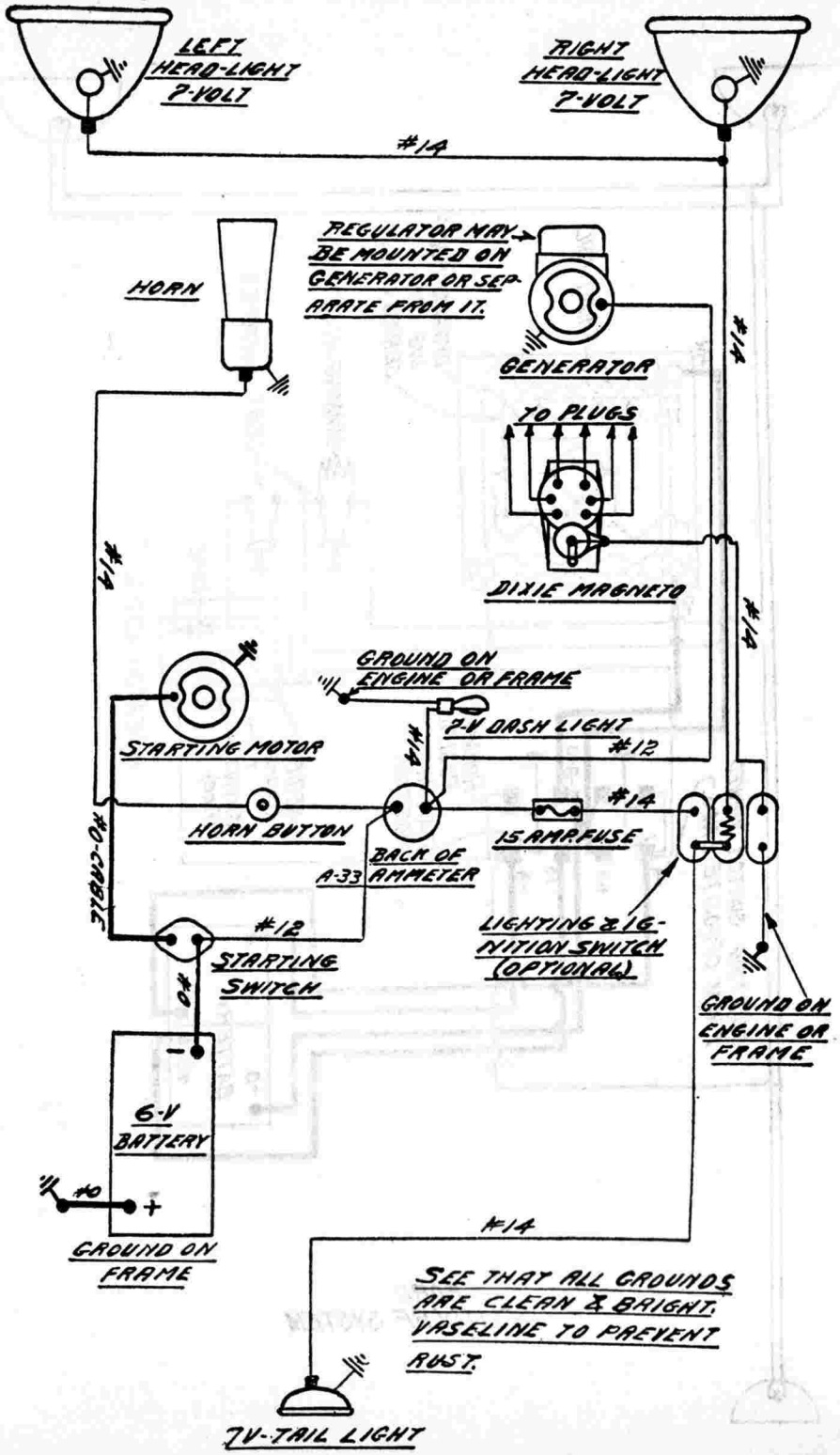
STA IMPULSE STARTER
AUTOMATIC TYPE



—WIRING DIAGRAM—



INTERNAL WIRING OF MAGNETO



Splitdorf

TWO UNIT GENERATING, STARTING AND LIGHTING SYSTEM

BATTERY.—Battery is 6 volt, 80-120 ampere-hour. The positive (+) terminal is grounded when the grounded system is used.

STARTER.—Starter is connected to engine through a Bendix drive.

OILING.—Put several drops of light engine oil in each of starter bearing oilers every month.

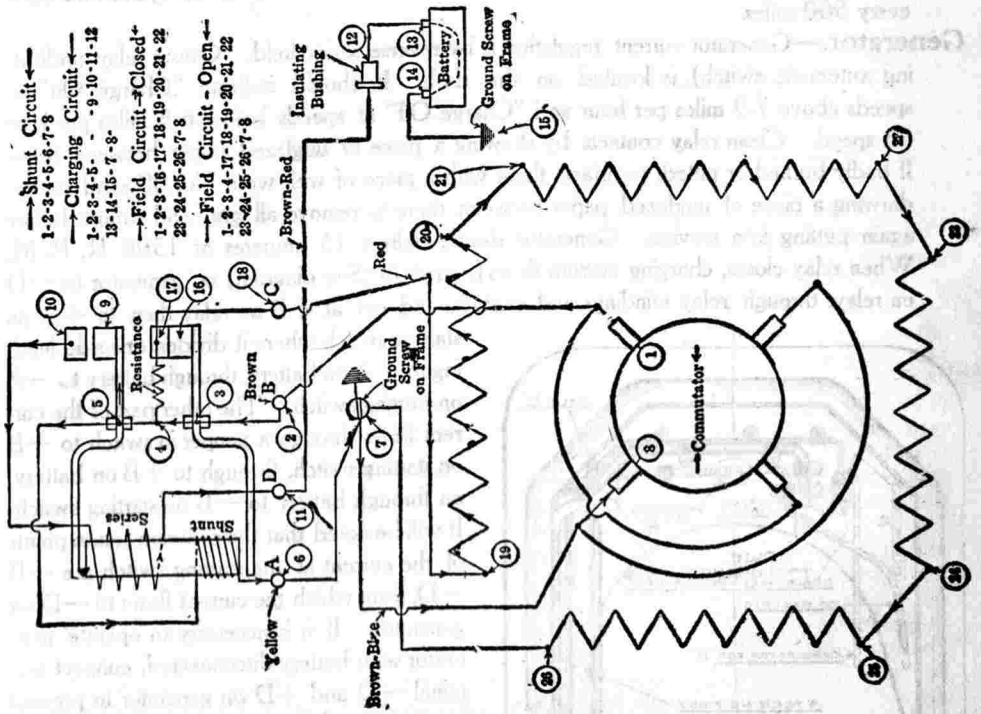
GENERATOR.—Generator current regulation is by a vibrating regulator. Internal circuits of generator and regulator are shown below. Maximum generator current is 15 amperes.

OILING.—Put several drops of light engine oil in each of generator oilers every two weeks. If car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

RELAY-REGULATOR.—Relay and regulator are combined in one unit. Relay closes at 7-9 and opens at 5-7 miles per hour. Charging current is 1-3 amperes at closing and the discharge current 0-1 ampere at opening of relay. Clean relay and regulator contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

LAMPS.—Head lamps are 6-8 volt, 15-21 cp. Dash lamp is 6-8 volt, 2-4 cp. Tail lamp is 6-8 volt, 2-4 cp.

FUSES.—Fuse is 15 ampere.



Ford

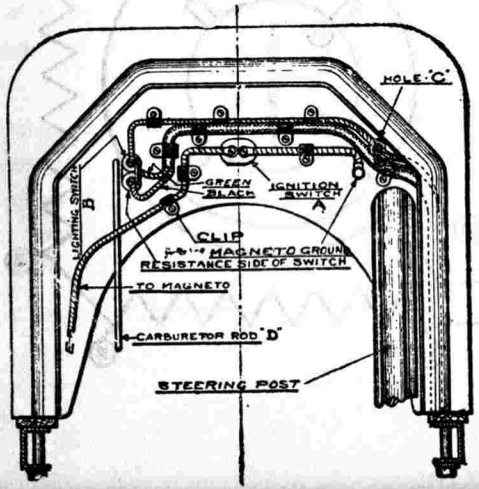
Splitdorf Starting and Lighting System

Battery.—Battery is 12 volt, 45 ampere-hour. The two wire system is used.

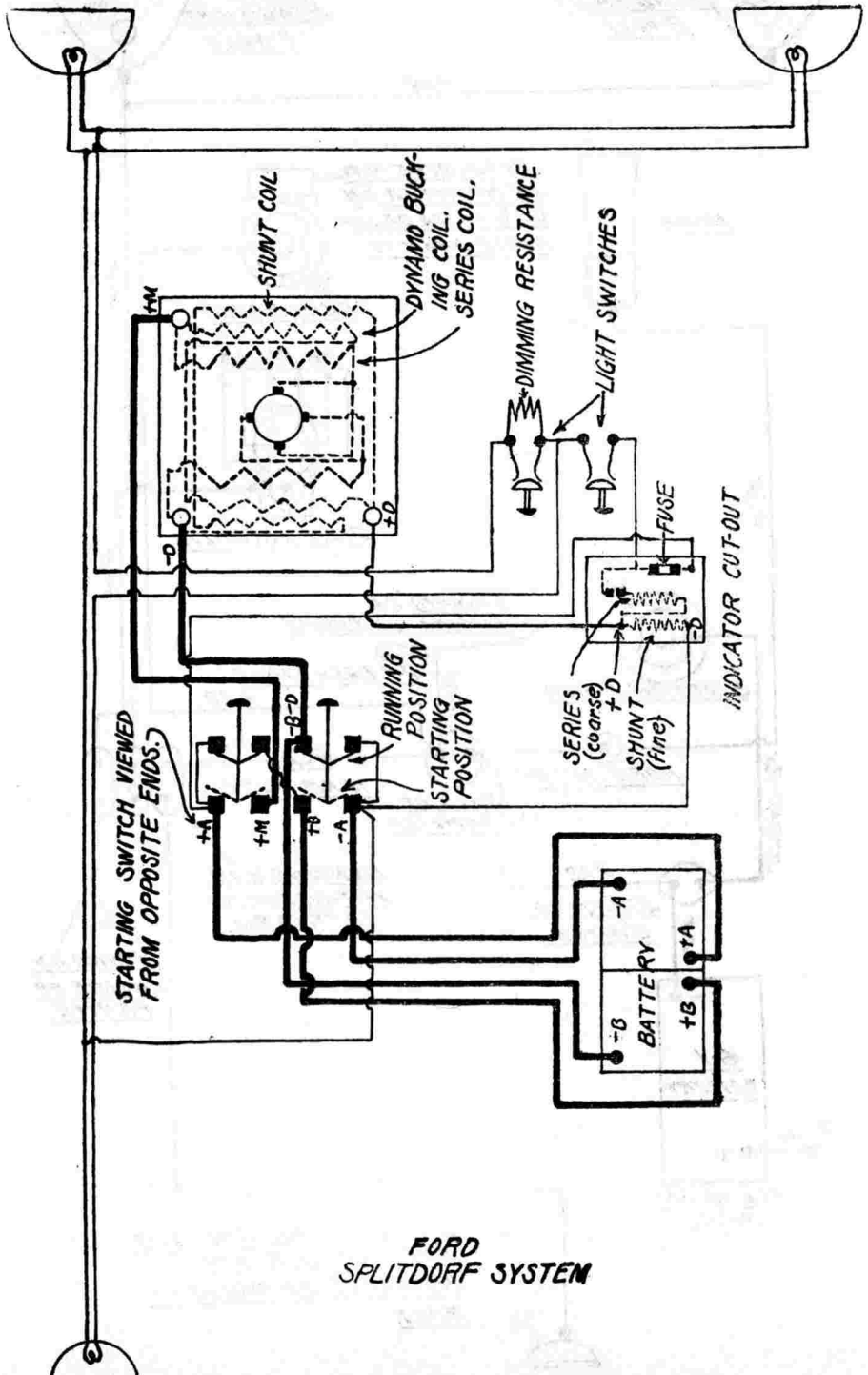
Starter.—Starter is chain connected to the engine crank shaft. Starter operates at 12 volts while generator and other equipment operates at 6 volts pressure. The starting switch changes battery connections so as to connect the two halves in series for starting and in parallel for charging. Cold engine, heavy oil, tight bearings, tight chain or other mechanical obstructions, or damp, grounded or short circuited motor windings or commutator will cause low speed with excessive current during the cranking operation. Discharged battery, defective battery connections, defective switch contacts, defective motor terminals, sticking brushes or dirty commutator will cause low speed with low current during cranking operation. Abnormal wear of brushes may be due to starting switch pedal sticking in hole in floor board. See that hole is large enough to allow switch to return to its normal position, and that good contact is made. This may be ascertained by removing switch cover. When the starting switch is depressed, the current flows from the terminal marked +A on the battery (See diagram) to +A on starting switch, through switch to +M and to +M on motor, through latter to —D on motor, to —B—D on switch, to —B on battery, through battery to +B on battery, then to +B on switch, through switch to —A, then to —A on battery and through battery returning again to +A, the starting point.

Oiling.—Put 4 or 5 drops of light engine oil in each of the motor-generator oilers every two weeks. If car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

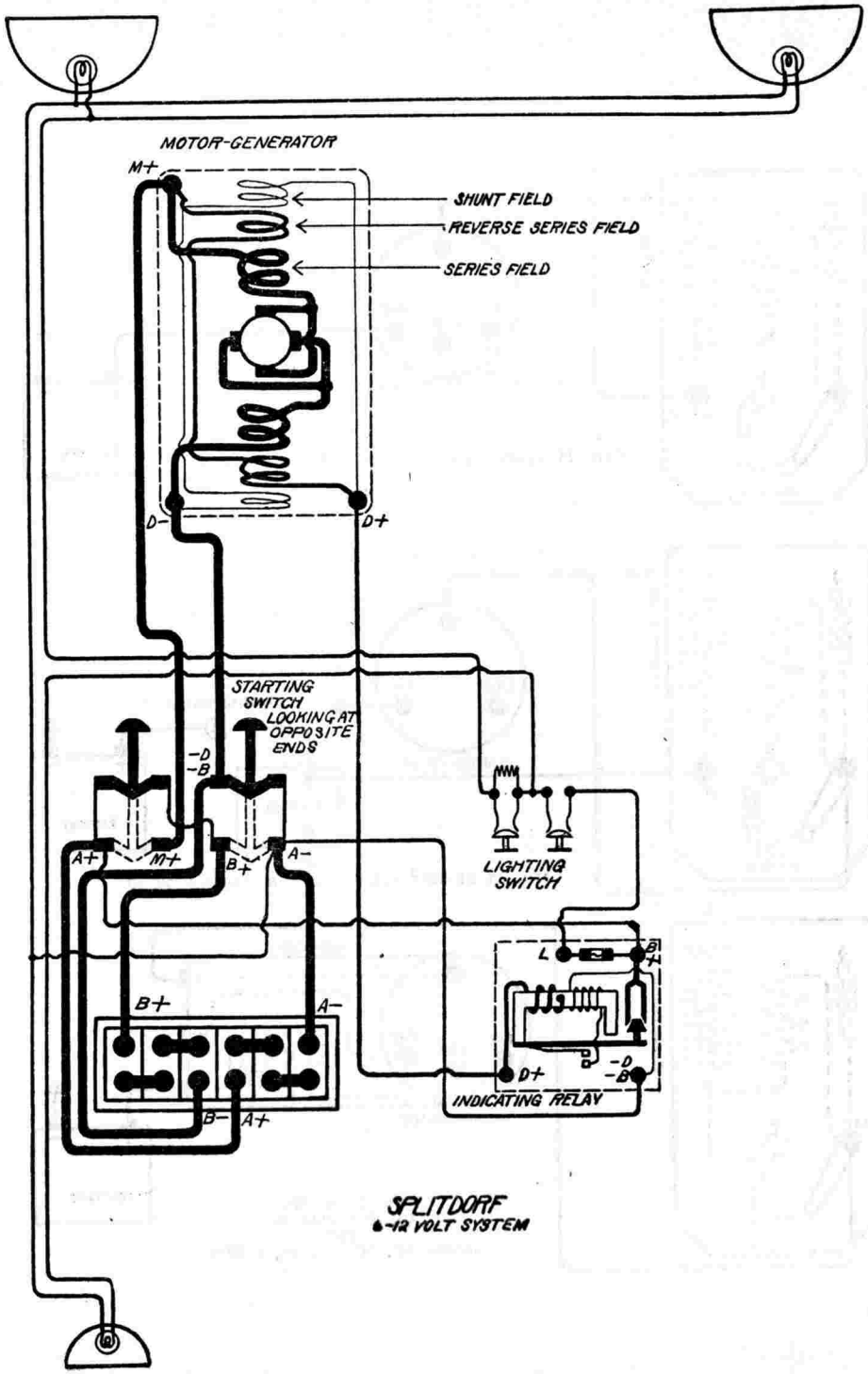
Generator.—Generator current regulation is by reverse series field. Cutout relay (indicating automatic switch) is located on the dash. It should indicate "Charge On" at speeds above 7-9 miles per hour and "Charge Off" at speeds below 6-8 miles per hour car speed. Clean relay contacts by drawing a piece of unglazed paper between them. If badly burned or pitted, resurface them with a piece of well worn No. 00 sand paper, drawing a piece of unglazed paper between them to remove all grit, and adjust, before again putting into service. Generator should deliver 15 amperes at 1500 R. P. M. When relay closes, charging current flows from +D (See diagram) on generator to +D on relay, through relay windings and contacts and out at +B on relay then to +A on starting switch where it divides. one side leading to +A on battery, through battery to —A on starting switch. The other part of the current flows through a jumper in switch to +B on starting switch, through to +B on battery, on through battery to —B on starting switch. It will be noted that the common return points of the current at the starting switch are —B —D, from which the current flows to —D on generator. If it is necessary to operate generator with battery disconnected, connect terminal —D and +D on generator to prevent burning out of windings and lamps.



Lamps.—Head lamps are 6-8 volts, 17 cp. Tail lamp is 6-8 volts, 2 cp, Double contact base is used.



FORD
SPLITDORF SYSTEM



SPLITDORF-APELCO

SINGLE UNIT 12-6 VOLT GENERATING, STARTING AND LIGHTING SYSTEM

BATTERY.—Battery is 12 volt, 35 to 70 ampere-hour. The negative (—) terminal of one set of three cells is grounded at the starting switch on cars using single wire lighting system.

STARTER.—Starter and generator are combined to form a single unit. Armature is permanently chain connected to engine crank shaft. Switch changes battery connections, connecting the two halves in series to supply 12 volts to starter and in parallel for charging at 6 volts. Internal connections of switch and generator are shown in diagram. When starting pedal is depressed, current flows from the terminal marked +A on the battery to +A on starting switch, through switch to +M and to +M on motor, through motor to —D on motor, to —B—D on switch, to —B on battery, through battery to +B on battery, then to +B on switch, through switch to —A, then to —A on battery and through battery, returning to +A, the starting point. Abnormal wear of brushes may be due to starting .witch pedal sticking in hole in floor boards.

GENERATOR.—Generator current regulation is by reverse series field. Generator current is 15 amperes at 1500 R.P.M. When relay closes, current flows from +D (See diagram) on generator to +D on relay, through relay windings and contacts and out at +B on relay, then to +A on starting switch where it divides, one side leading to +A on battery, through battery to —A on starting switch. The other part of the current flows through a jumper in switch to +B on starting switch, though to +B on battery, on through battery to —B on starting switch. It will be noted that the common points of the current at the starting swich are —B—D, from which the current flows to —D on generator. If it is necessary to operate generator with battery disconnected, connect terminal —D and +D on generator to prevent burning out of windings and lamps.

RELAY.—Cutout relay closes at 7-9 miles per hour and opens at 5-7 miles per hour. Charging current is 1-3 amperes at closing and the discharge current 0 to 1 ampere at opening of relay. Clean relay contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

LAMPS.—Head lamps are 6-8 volt, 14-21 cp. Dash lamp is 6-8 volt, 2 cp. Tail lamp is 6-8 volt, 2 cp.

FUSES.—Fuse on back of relay-indicator is 20 ampere.

TEAGLE MAGNETO

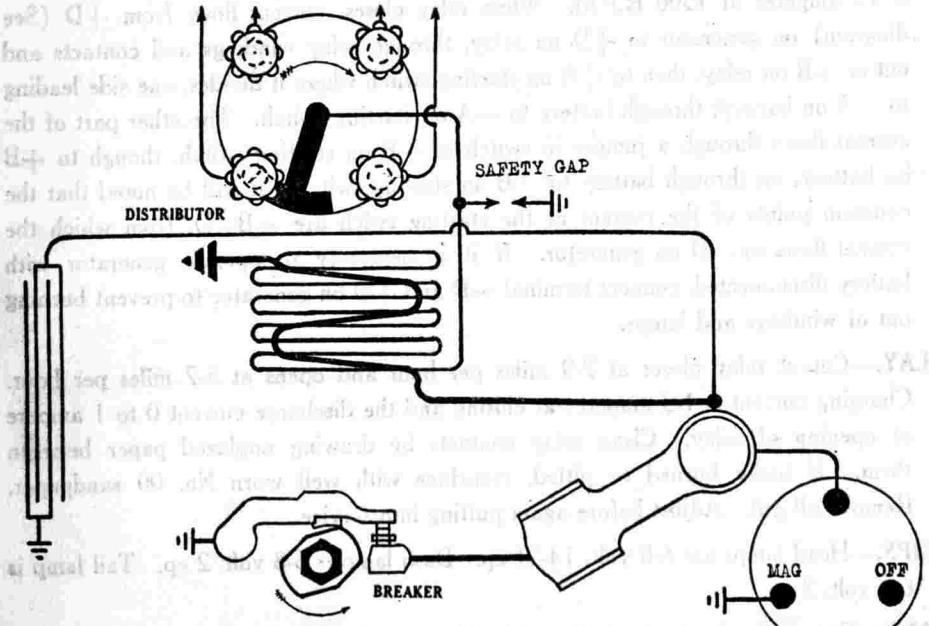
MODELS 50, 60, 66, 77, 77-B AND 77-V

ROTATION.—The Teagle Magneto is made to rotate in a clockwise direction only, when facing driving end of the magneto.

BREAKER.—The breaker points separate .015 inch. To adjust contact gap, first revolve cam until breaker arm is fully lifted or until contact is fully separated, then loosen the lock nut on breaker arm, turn the screw down until the breaker gap is fully closed. Now turn back the breaker screw one-half turn and this will give breaker opening of exactly .015 inch. If condition of the contact points affects the ignition, remove and resurface with a special magneto file. Do not file off any more than is necessary to clean points. Emery cloth should not be used to dress down or clean the points. The breaker arm should be in perfect alignment, and if it is necessary to bend the arm to procure perfect alignment, use tool No. 999 (bending tool used by the Teagle Co., of Cleveland, O.).

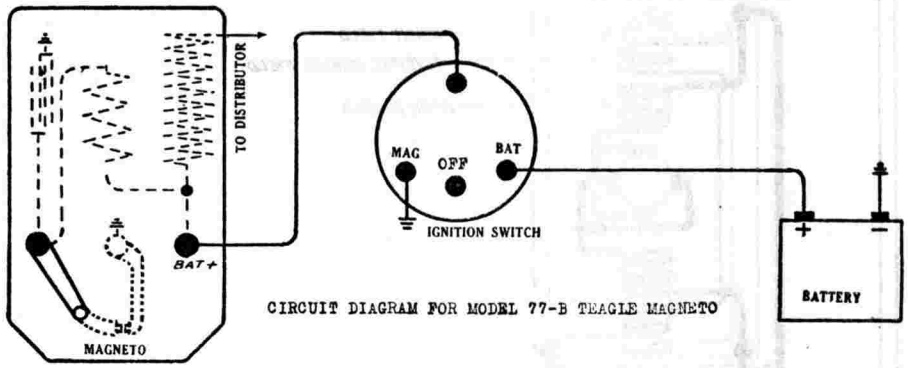
TIMING.—Turn the engine over until piston No. 1 is at top dead center on compression stroke, advance lever of magneto set at fully retarded (advance lever moved in clockwise direction as far as it will go) position. Remove the distributor cover and breaker cover from magneto and turn magneto shaft in the direction of rotation until brass distributor segment is just approaching the lower left hand section when facing the distributor. Rotate magneto shaft very slowly until breaker points just begin to separate. A convenient way of determining this exactly is to place a piece of thin tissue paper between the points and notice the exact point at which the pressure on the paper is released. If the specifications of the engine manufacturer call for a magneto setting other than full retard at top dead center, the magneto should be timed according to the manufacturer's specifications.

OILING.—Fill oilers on both ends of the magneto with light engine oil at least every 1000 hours of running. No oil should be used on the interrupter or breaker, as oil will foul points and prevent good contact, cause sparking, burning and misfires. Care chould be exercised to prevent oil from entering the breaker housing.

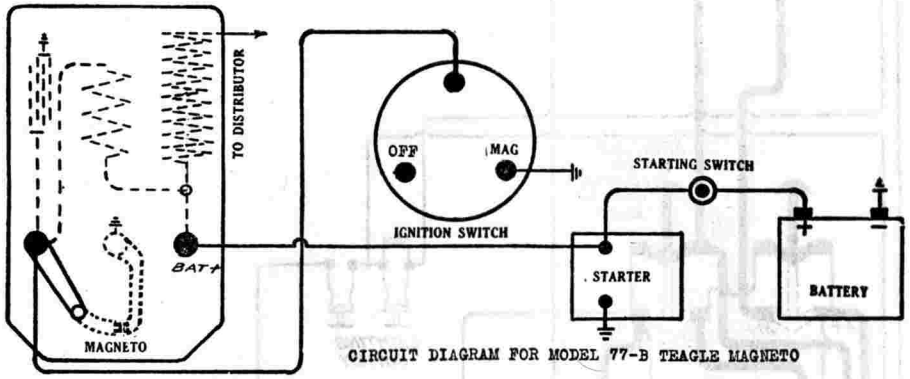


CIRCUIT DIAGRAM FOR MODEL LR-98 TEAGLE MAGNETO

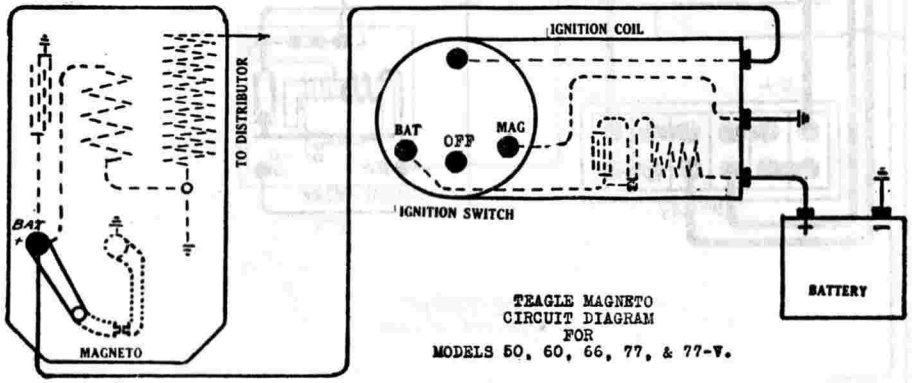
IGNITION SWITCH



CIRCUIT DIAGRAM FOR MODEL 77-B TEAGLE MAGNETO



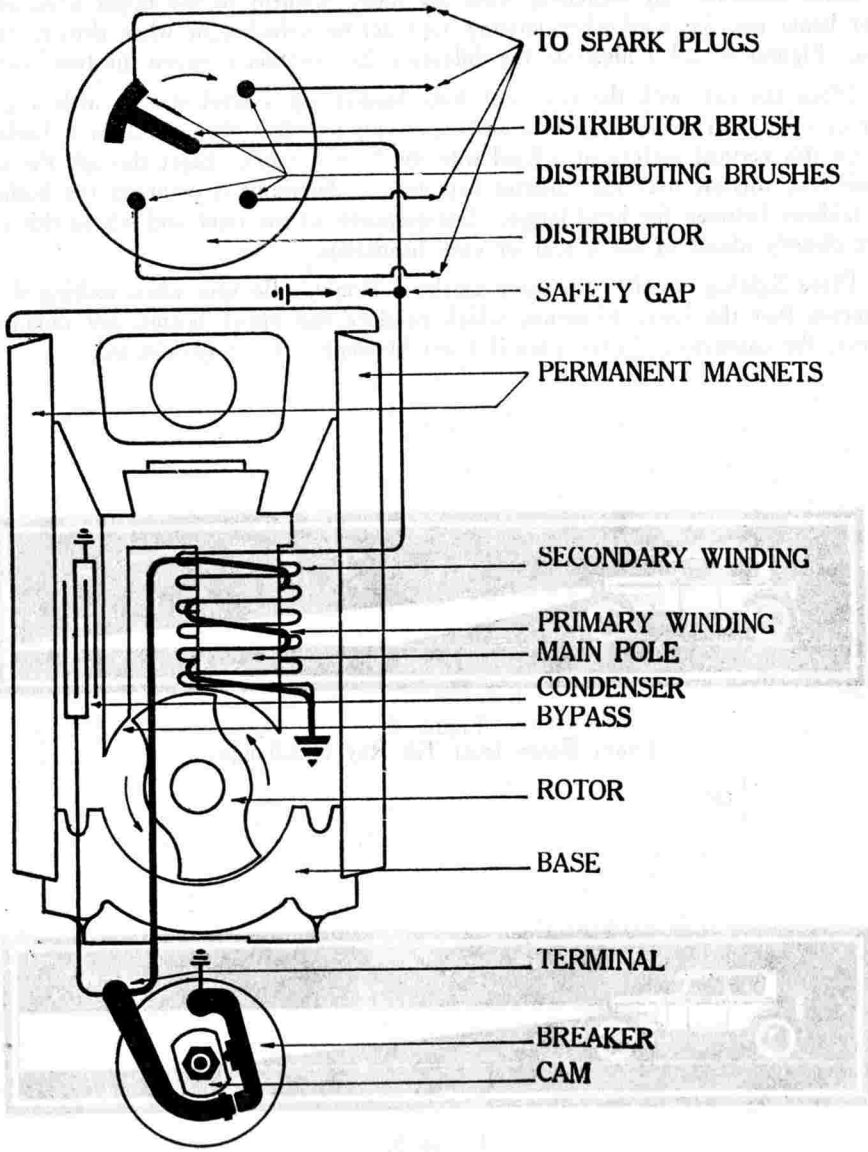
CIRCUIT DIAGRAM FOR MODEL 77-B TEAGLE MAGNETO



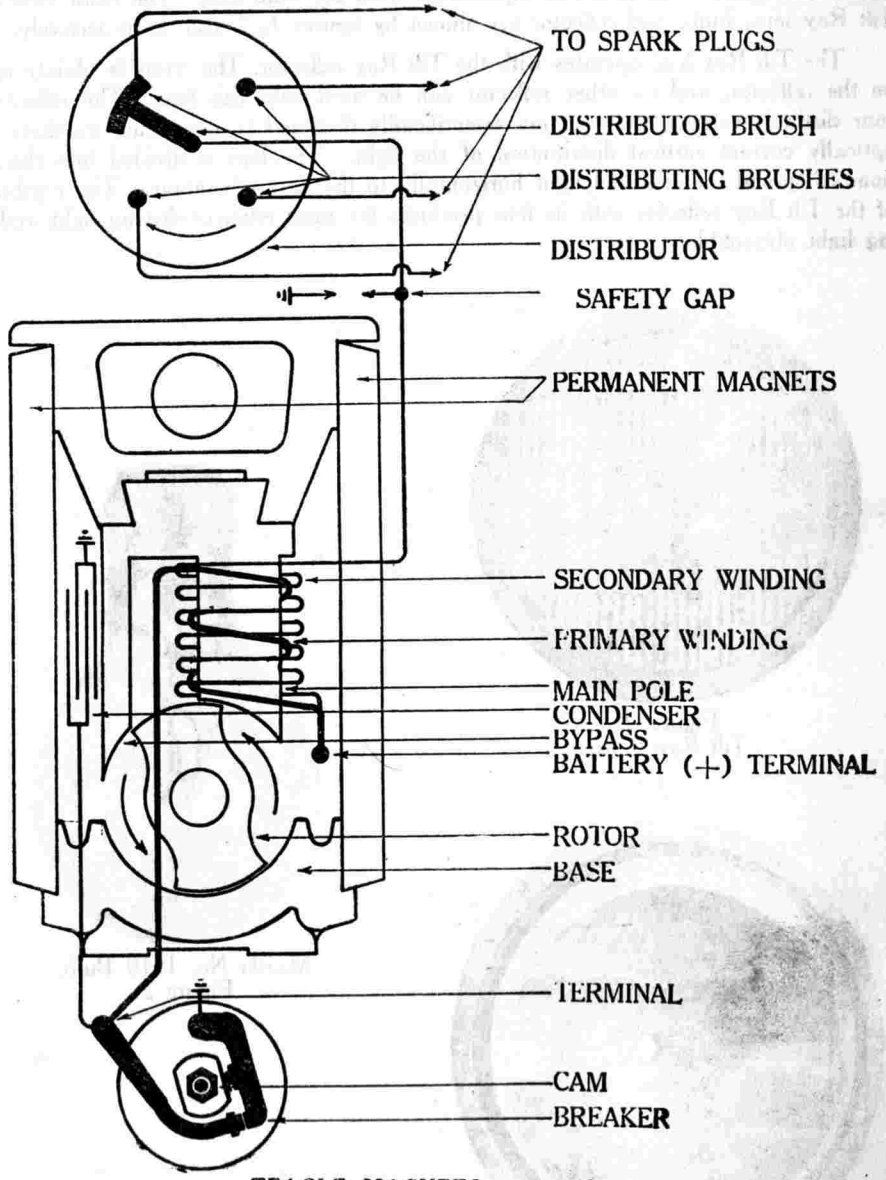
TEAGLE MAGNETO
CIRCUIT DIAGRAM
FOR
MODELS 50, 60, 66, 77, & 77-V.

TEAGLE MAGNETO

MODELS 50, 60, 66, 77 AND 77-V, AND MODEL 77-B



TEAGLE MAGNETO
Models 50, 60, 66, 77 and 77-V



TEAGLE MAGNETO
Model 77-B

TILT RAY HEADLAMPS

The Tilt Ray Headlighting device consists primarily of a special lens operating in conjunction with a special reflector and a bulb having two 21 cp. filaments separated about one eighth of an inch and equidistant from the bulb axis. The front view of the Tilt Ray lens, bulb, and reflector are shown by figures 1, 2 and 3, respectively.

The Tilt Ray lens operates with the Tilt Ray reflector. The name is plainly marked on the reflector, and no other reflector can be used with this lens. The reflector has four distinct sections, each section scientificailly designed to contribute its share to an optically correct vertical distribution of the light. The lens is divided into three sections to spread the reflected light horizontally to the best advantage. The combination of the Tilt Ray reflector with its lens produces the most efficient driving light and passing light obtainable.

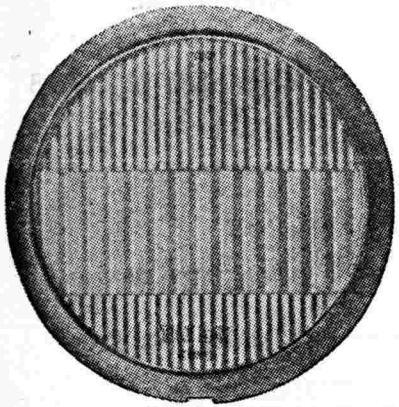
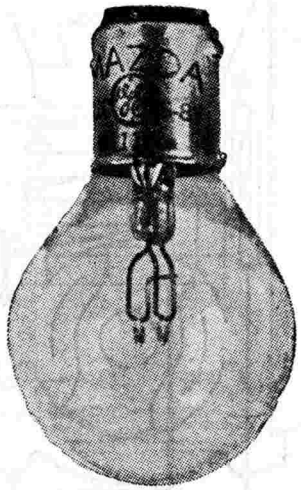


Figure 1.
Tilt Ray Lens.



Mazda No. 1110 Bulb.
Figure 2.

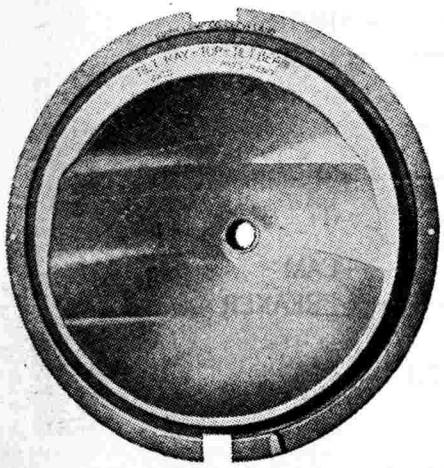


Figure 3.
Tilt Ray Reflector.

Two distinct and separate beams of light, one higher than the other, are available with Tilt Ray Headlamps. The upper beam, which is the driving beam, is produced by the lower filament. By switching from the lower filament to the upper filament, the lower beam may be used when passing approaching vehicles, or when driving around town. Figures 4 and 5 illustrate the difference in elevation between the two beams.

Place the car, with the rear seat fully loaded, on a level stretch with a garage door or other light colored vertical surface twenty-five feet ahead. Draw a horizontal line on this vertical surface at a level with the lamp centers. Sight through the center of the rear window over the radiator cap and so determine a point on the horizontal line midway between the head lamps. Locate points at the right and left of this center point directly ahead of the center of each headlamp.

Place lighting switch on position marked "Bright.' Be sure when making the adjustments that the lower filaments, which produce the upper beams, are illuminated. Reverse the connections in the plug if lower filaments are not illuminated.

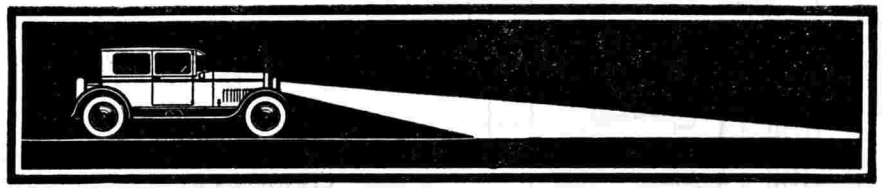


Figure 4.
Lower Beam from Tilt Ray Headlamps.

Figure 5.
Upper Beam from Tilt Ray Headlamps.

TILT RAY HEADLAMPS

Cover one headlamp to obscure the light beam. The best driving beam is obtained when there is a high intensity near the top of the beam. Turn the focus adjustment screw in the back of the uncovered lamp until the beam having a high intensity at the top and a sharp upper outline is as narrow as possible measured from top to bottom. Then by loosening the bracket adjusting bolt, aim the lamp so that the top of the beam coincides with the horizontal line on the vertical surface, and is equally divided by the vertical line directly ahead of the headlamp center. Tighten the bracket bolt securely. The correct adjustment for the right headlamp will look like Figure 6. Repeat operations with the other lamp and the headlamps will be adjusted properly.

No further adjustments for the lower beams are needed.

One point that should be kept in mind is that the top of the beam should cut off as sharply as possible, and results frequently can be improved by turning the bulb over in the socket when the beam is not satisfactory with the bulb as first installed.

This equipment is designed to operate with Mazda No. 1110 lamps illustrated by figure 2.

Care should be taken when replacing a lens, to engage the lug which anchors the lens in the lens notch to prevent rotation and also to insure the flutes being vertical. Both the reflector and lens are notched and also marked "TOP" so that they can be mounted only in the correct position. Tilt Ray and Tilt Beam headlamps are equipped with the standard S.A.E. headlamp mounting or its equivalent.

No portion of main beam should rise higher at twenty-five feet than the level of the centers of the lamps when car is loaded.

Tilt Ray headlamps are approved by the various State Lighting Commissions and manufactured under the patents controlled by and pending to the Guide Motor Lamp Manufacturing Company, Cleveland, Ohio.

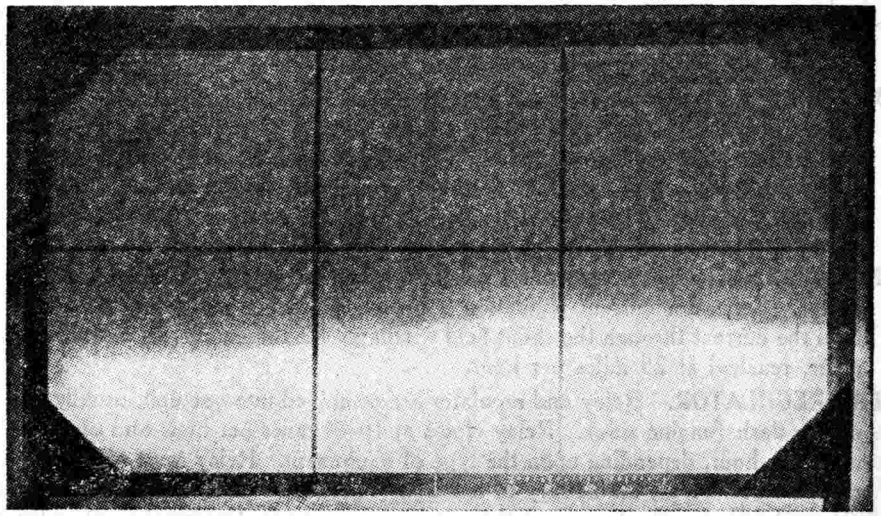


Figure 7.
Lower Beam of Tilt Ray Headlamp shown in Figure 6.

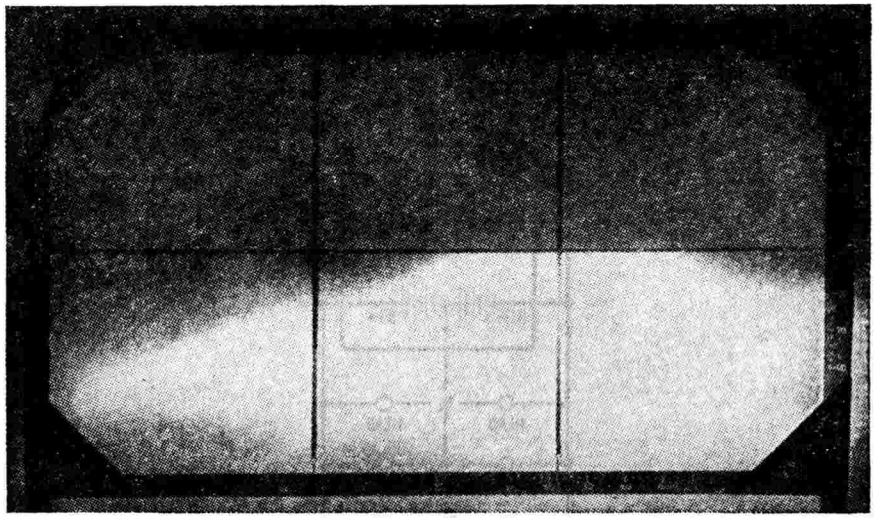


Figure 6.
Upper beam of right hand Tilt Ray Headlamp correctly focused and aimed.

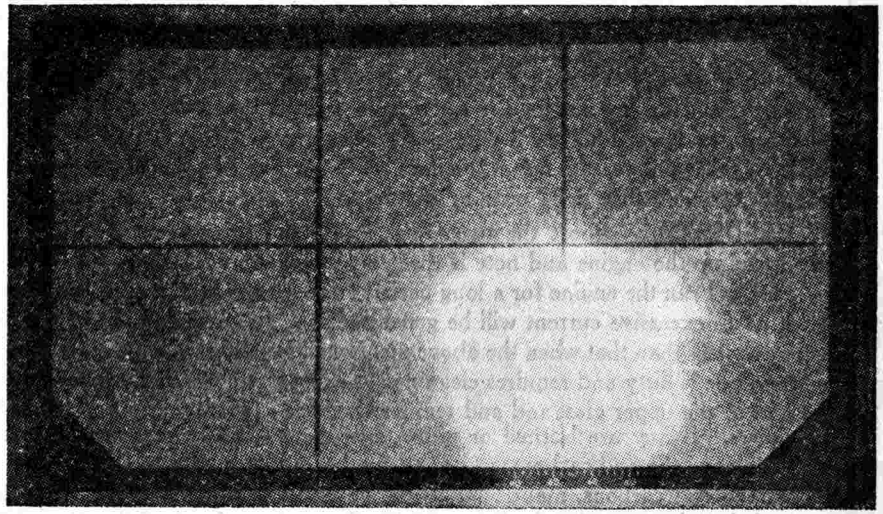


Figure 8.
Upper Beam from Tilt Ray Headlamp without lens.

U. S. L.

GENERATING AND STARTING SYSTEM
24-12 VOLT EXTERNALLY REGULATED TYPE

BATTERY.—U. S. L., Type EL-1207 or EL-1209, 24 volt, 25 ampere-hour. The two-wire system is used. The battery is divided into two sections of 6 cells each. The starting switch, when depressed, connects the two sections of the battery in series, providing 24 volts for operating the motor-generator as a starter to crank the engine. When in the normal position, the switch connects the two sections of the battery in parallel for charging.

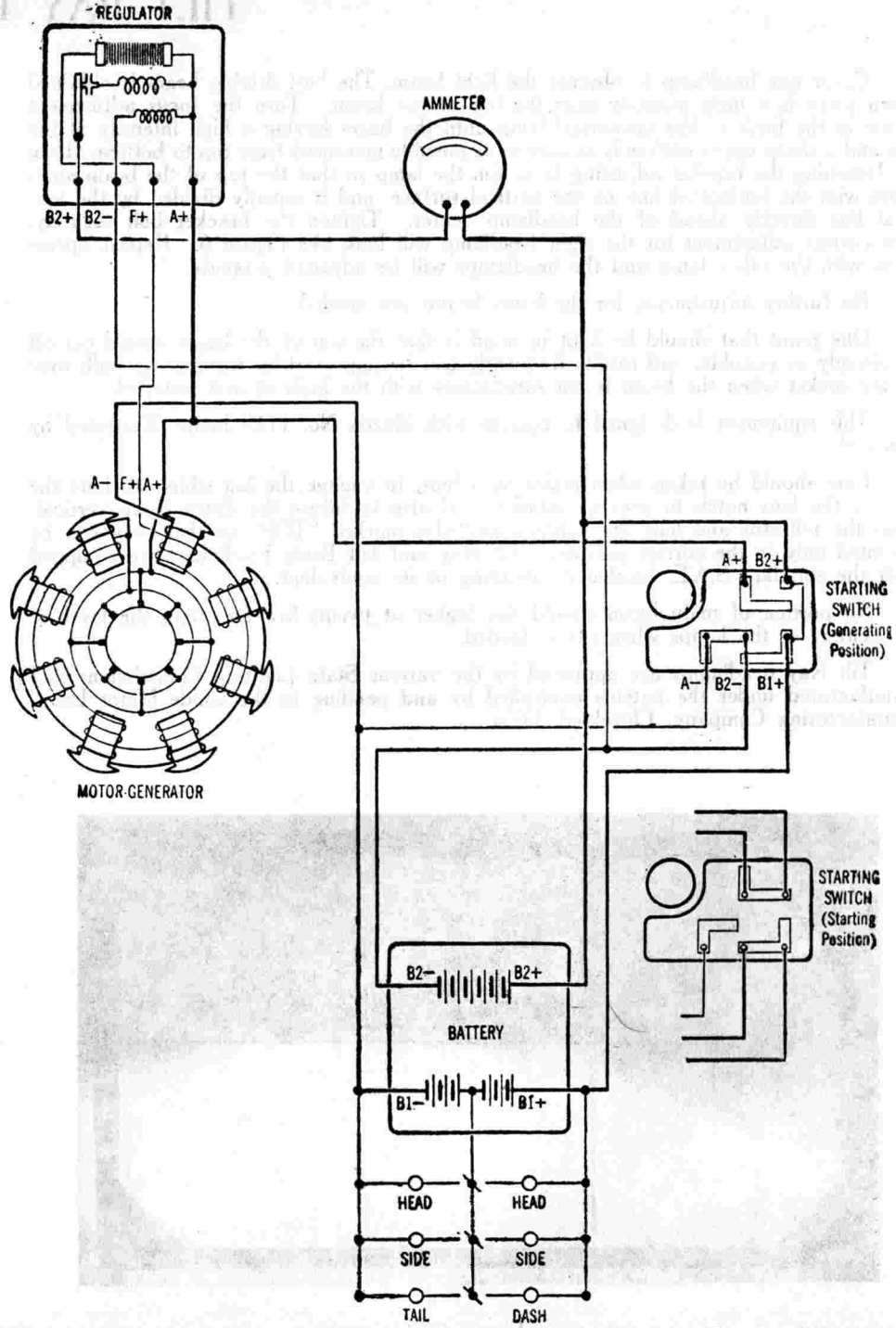
MOTOR-GENERATOR.—Starter and generator are combined into one unit. The armature is fastened to the rear end of the crankshaft, taking the place of the flywheel. The machine has eight poles and eight brushes, each pole being wound with a series and a shunt coil. All of the field coils and brushes are used in both starting and generating operations. Pressure of brushes on the commutator is 1¾ pounds for Type E-12 and 1¼ pounds for all other types.

GENERATOR.—The unit operates as a generator when the engine is running under its own power. Generator current regulation is by special carbon-pile regulator, which controls the current through the shunt field winding. Maximum current output is 18 amperes, reached at 25 miles per hour.

RELAY-REGULATOR.—Relay and regulator are combined into one unit, usually mounted on the dash (engine side). Relay closes at 10-14 miles per hour and opens at 8-10 miles per hour, depending upon the type of equipment. Relay must open with a discharge current from the battery of less than 4 amperes. If more than 4 amperes are required, increase the tension of the relay lever spring by turning the nut at the right hand side. The pile of carbon discs is connected in series with the shunt field winding of the generator. The resistance of the pile, and hence the current which passes through it (and the shunt field), depends upon the pressure with which the discs bear against each other. The core upon which the relay coils are wound, also has a magnetic attraction for a lever arm, which normally bears on the carbon pile, aided by a spring. As the charging current increases in the heavy winding of the relay, a greater attraction is exerted on the regulator lever arm, decreasing its pressure on the carbon pile, thereby increasing the resistance of the same, which in turn causes a reduction in the shunt field current and magnetic field of the generator. The regulator is normally adjusted to limit the maximum current output of the generator to 18 amperes. Screwing in the lower plug on the regulator lever arm will increase the output, and screwing it out will have the opposite effect. The air gap between the lever and coil core must not be less than 3/32 inch, or greater than ⅛ inch.

TO TEST REGULATOR.—Short the two lower right-hand terminals (F and A), then slowly speed up the engine and note if the relay closes considerably earlier than normally. Do not run the engine for a long period or at a high speed with these terminals shorted, as an excessive current will be generated. If the relay does close at a speed considerably less than that when the above mentioned terminals are not short circuited, the carbon pile is dirty and requires cleaning. To clean cabonr pile, unscrew the plug at the end of the upper glass rod and remove the rod. Then remove and inspect the carbon discs. If any are burned or pitted, rub them together or against a smooth board. Remove the end carbons and clean the brass plates with fine sandpaper. In replacing the end carbons, make sure that they make firm contact with the brass plates and that the screw heads do not project beyond the faces of the discs. After the carbon pile has been reassembled, it must be adjusted as above.

TOURING AND STARTING SWITCHES.—For information concerning the touring switch or starting switch see Page 424.



U. S. L. Generating and Starting System, 24-12 Volt Externally Regulated Type

U. S. L.

GENERATING AND STARTING SYSTEM

12 VOLT INHERENTLY REGULATED TYPE

BATTERY.—Battery is 12 volt, 85 ampere-hour. Either the two-wire system is used or the negative (—) terminal is grounded.

MOTOR-GENERATOR.—Starter and generator are combined into one unit. The armature is fastened to the crankshaft, taking the place of the flywheel. There are eight field poles and eight brushes. Six poles carry only series coils, one pole is wound with the shunt coil, and the other pole is wound with a series coil and a coil called the compensating field winding. Starting switch is of the magnetic type, controlled by a button on the dash.

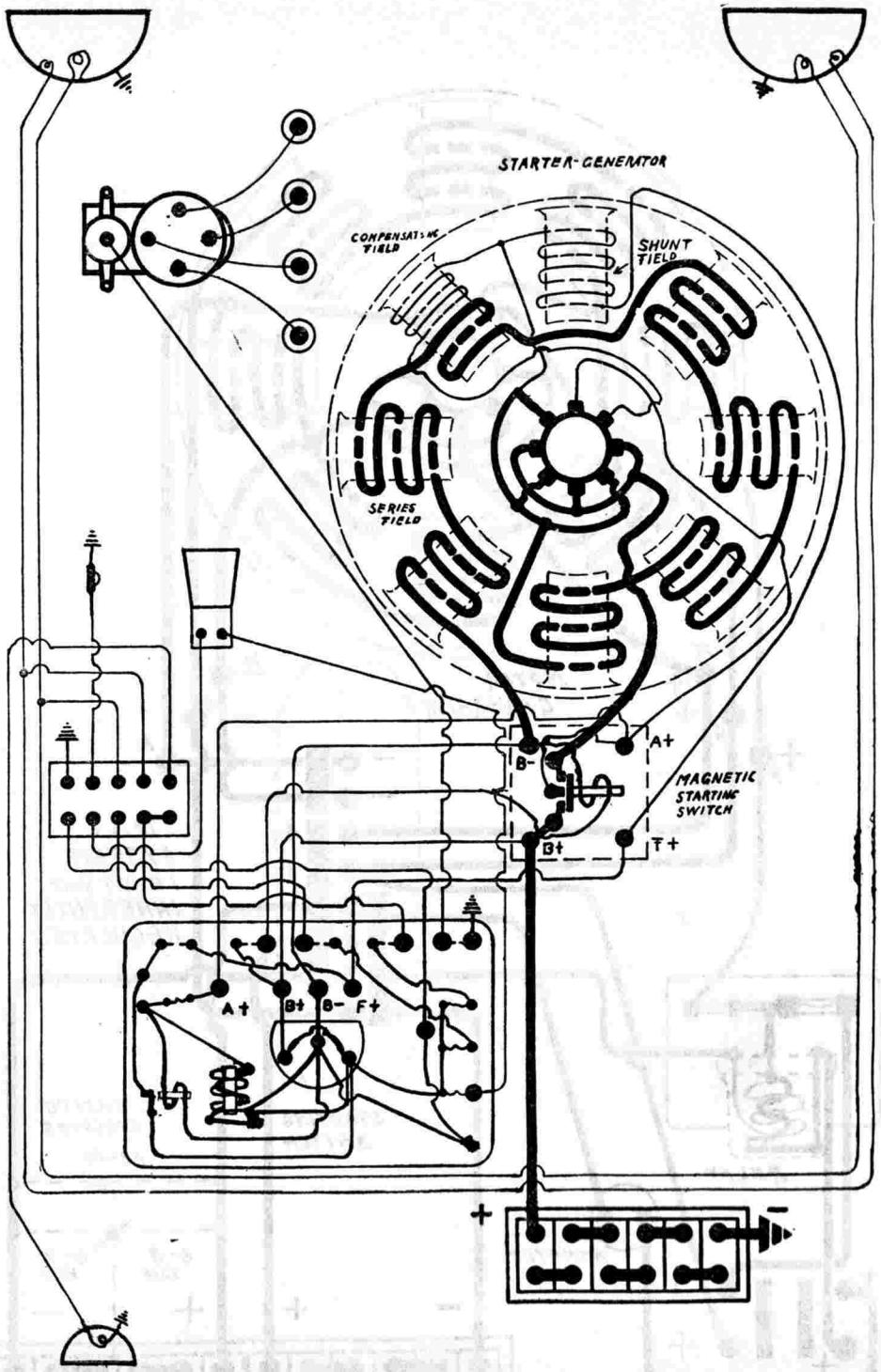
GENERATOR.—Generator output regulation is by reverse field and armature reaction. Maximum current output is 10 amperes, reached at 15 miles per hour or 600 R.P.M. of the armature. In some cases, an external resistance coil is provided, same being connected in series with the shunt field, and the output of the generator may be varied by altering the value of the resistance. However, in most cases no means are provided for adjusting the charging rate. Shunt field winding takes 1.3 amperes at 15 volts. Pressure of the brushes on the commutator is 1¾ pounds.

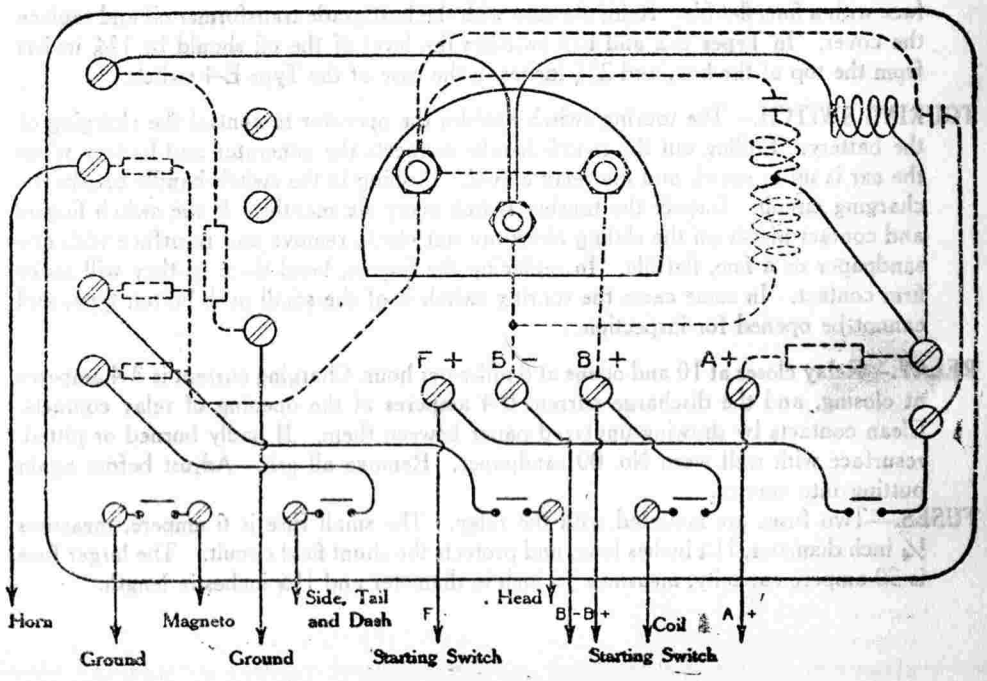
INSTRUMENT PANEL.—The starting button, ammeter, relay, special shunt field circuit breaker, touring switch, magneto switch, lighting switches and fuses are mounted on

RELAY.—Relay closes at 10 and opens at 8-9 miles per hour. Relay closes at 400 R.P.M. of the armature. Relay contacts separate 1/16 inch. Clean contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before putting into service.

FUSES.—Generator fuse in the "A+" lead is 30 ampere. Other fuses are of 10-ampere capacity.

NOTE.—Terminal "B—" on the Magnetic Starting Switch is Grounded.





Wiring Diagram Instrument Board—Rear View

U. S. L.

24-12 VOLT INHERENTLY REGULATED TYPE

BATTERY.—U. S. L., Type EL-1207 or EL-1209, 24 volt, 25 ampere-hour. The two-wire system is used. Battery is divided into two sections of 6 cells and 12 volts each. The starting switch connects the two sections in series, providing 24 volts to operate the motor-generator as a starter to crank the engine, or in parallel when the motor-generator is operating as a generator and charging the battery.

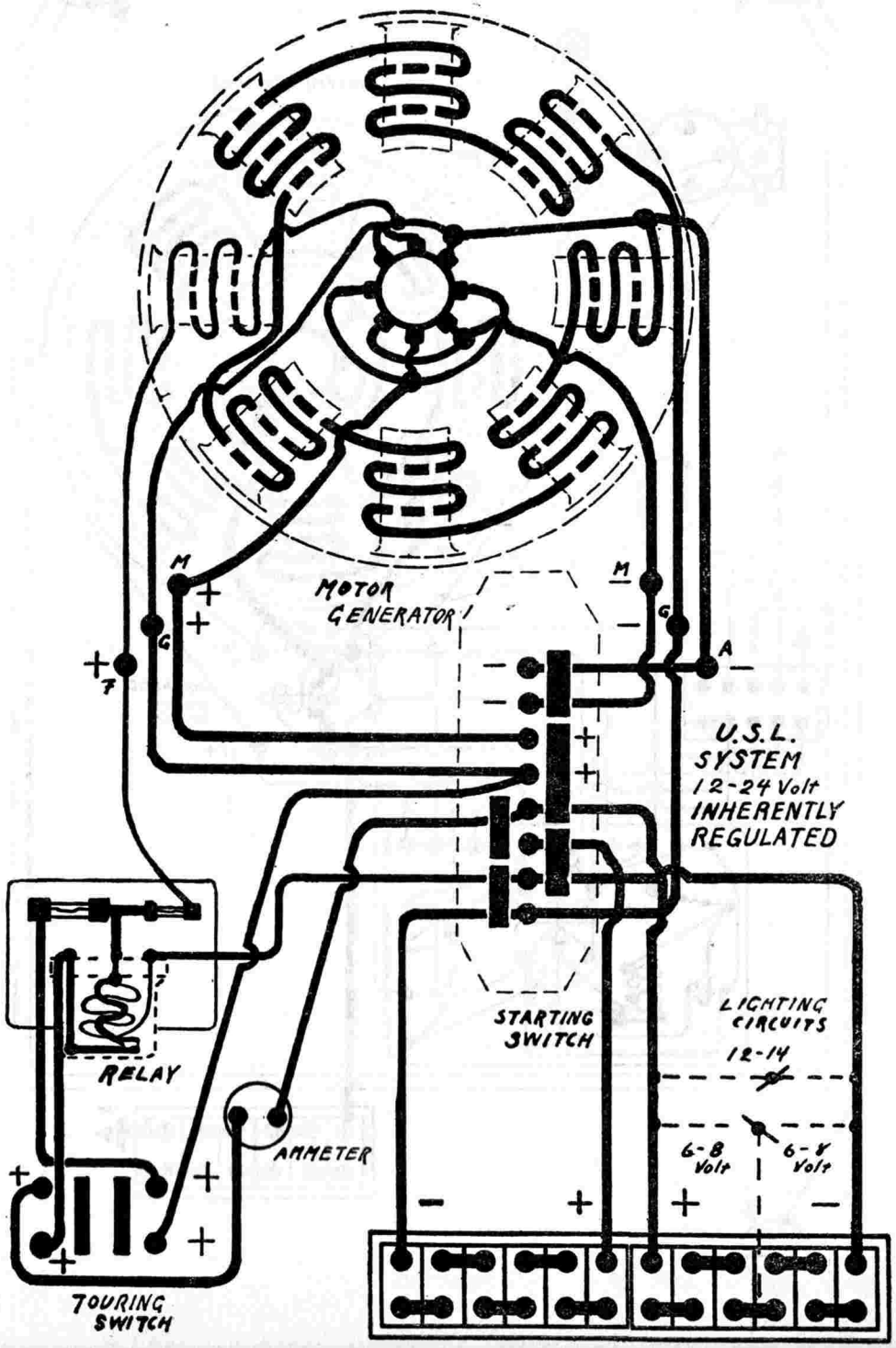
MOTOR-GENERATOR.—Starter and generator are combined into one unit. The armature, which revolves outside the field poles, is fastened to the crank shaft, taking the place of the flywheel. The machine has eight field poles and eight brushes. The generator shunt field winding is wound on one pole only, the other seven poles being wound with the series coils. Generator current regulation is by reverse series field and armature reaction. Only the three lower brushes (the three upper brushes of Plate No. 500N) are used when the machine is operating as a generator. Pressure of these three brushes on the commutator must be 1¾ pounds. Pressure of the other five brushes is 1¼ pounds. Maximum charging rate is 18 amperes, reached at 20 miles per hour.

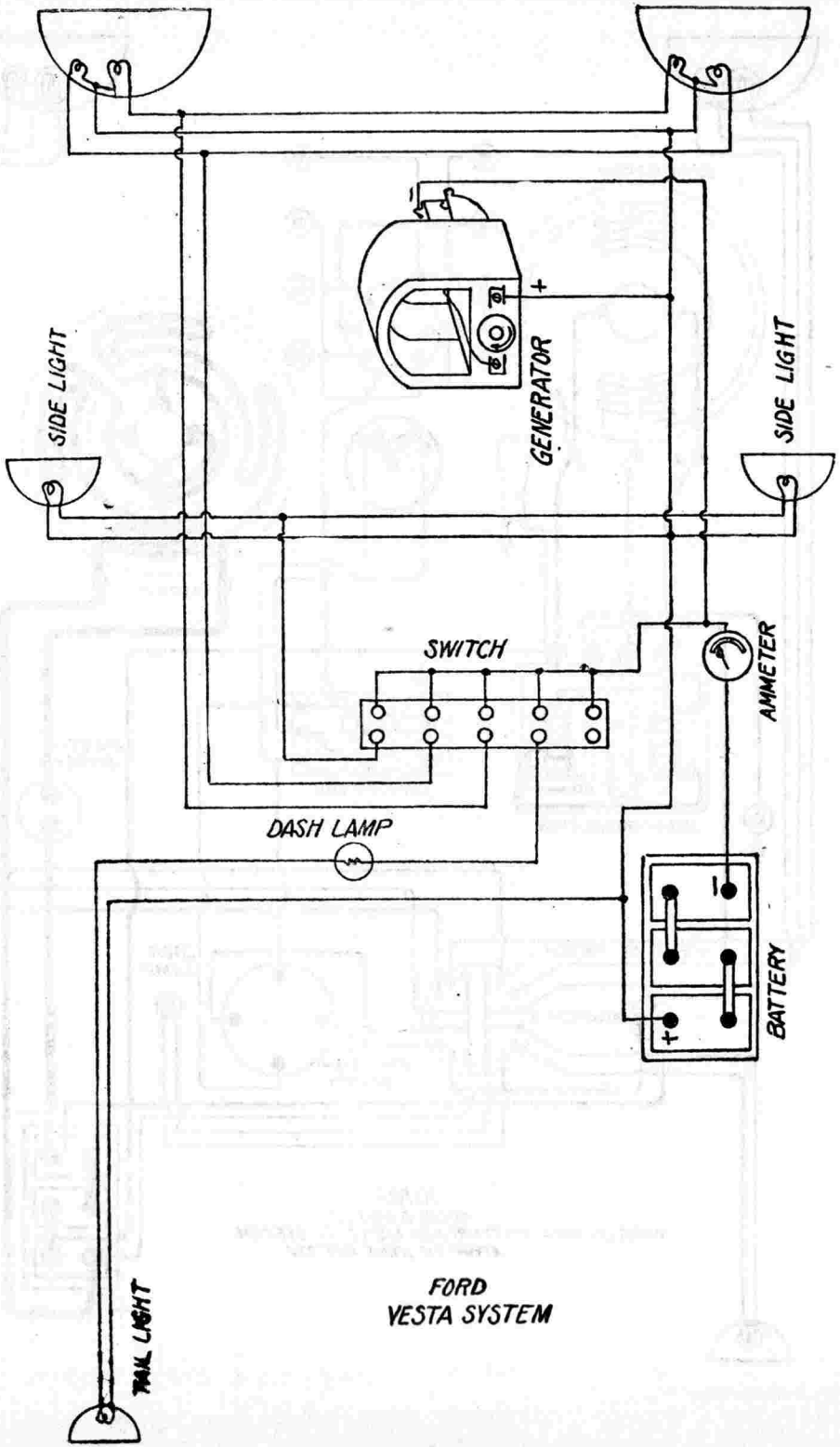
STARTING SWITCH.—The starting switch operates in oil, which must be renewed once a year. Before opening the switch case, disconnect the positive (+) battery leads, to prevent accidental short-circuits. Remove the top of the case and pour out the old oil. Make sure all the switch fingers bear properly against the drum. If they do not, they may be made to do so by bending. If contacts are badly burned or pitted, resurface with a fine, flat file. Refill the case with the best grade transformer oil and replace the cover. In Types E-2 and E-3 switches the level of the oil should be 1⅝ inches from the top of the box, and 2¾ inches in the case of the Type E-4 switch.

TOURING SWITCH.—The touring switch enables the operator to control the charging of the battery. Pulling out the switch handle connects the generator and battery when the car is up to speed, and the relay closed. Pushing in the switch handle breaks the charging circuit. Inspect the touring switch every six months. If the switch fingers and contact pieces on the sliding block are not clean, remove and resurface with fine sandpaper or a fine, flat file. In replacing the fingers, bend them so they will make firm contact. In some cases the touring switch is of the small push-button type, and cannot be opened for inspection.

RELAY.—Relay closes at 10 and opens at 8 miles per hour. Charging current is 3-4 amperes at closing, and the discharge current 0-4 amperes at the opening of relay contacts. Clean contacts by drawing unglazed paper beween them. If badly burned or pitted resurface with well worn No. 00 sandpaper. Remove all grit. Adjust before again putting into service.

FUSES.—Two fuses are mounted with the relay. The small fuse is 6 ampere, measures ¼ inch diameter, 1¼ inches long, and protects the shunt field circuit. The larger fuse is 30-ampere capacity, measures ⅜ inch in diameter and 1¼ inches in length.





FORD
VESTA SYSTEM

Ford

Vesta System

Battery.—Battery is 6 volt, 80 ampere-hour. The two wire system is used.

Starter.—There is no starter supplied to this system.

Generator.—Generator is of the permanent field type. Two types of generators are supplied, the large type, D, and a smaller type F. There is no current or voltage regulation except that which takes place due to armature reaction. The machine is designed to deliver its normal output at average driving speeds.

GENERATOR DATA.

Model D		Model F	
R. P. M.	Amperes	R. P. M.	Amperes
600	0	1000	0.0
710	1	1100	.5
820	2	1170	1.
930	3	1300	1.5
1040	4	1450	2.5
1200	5	1720	3.75
1350	6	2100	5.75
1500	7	2500	7.5
1715	8		
1960	9		
2200	10		

There is no relay. There is a centrifugally operated governor at one end (See Plate No. 241A) which automatically disconnects generator from battery when the armature speed drops below that required to charge battery.

Oiling.—Put 3 or 4 drops of light engine oil in each of the generator bearing oilers and put one drop of oil on governor pivots every two weeks. At the same time lubricate the driving chain well, using light engine oil. If car is driven more than 500 miles in two weeks, the oiling must be done every 500 miles.

Lamps.—Head lamps are 6-8 volts, 14 cp. Dimmer lamps are 6-8 volts, 2 cp. Side lamps are 6-8 volts, 2 cp. Dash and tail lamps are in series. They are each 3-4 volts, 2 cp.

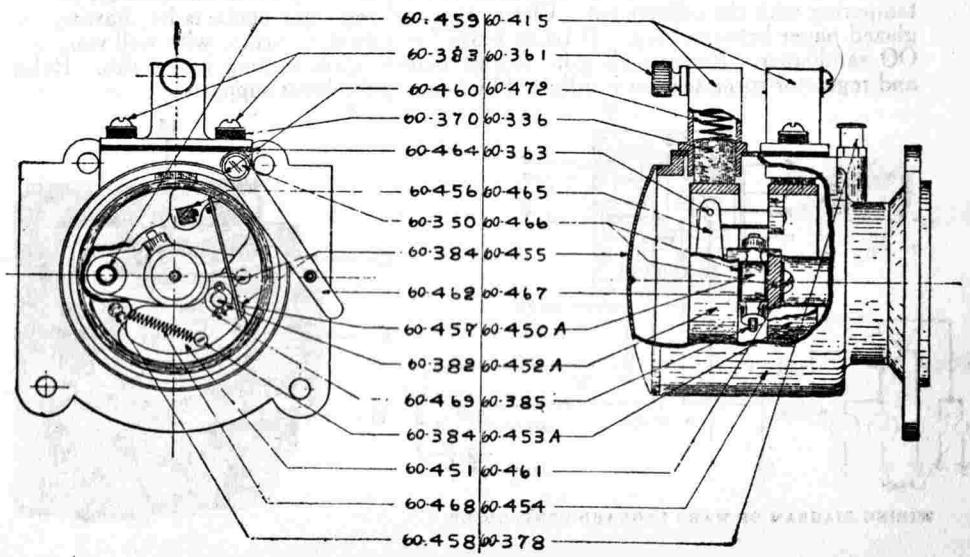


PLATE NO.

Diagram Showing Cutout Assembly and Parts Numbers.

WARD LEONARD

GENERATING AND STARTING SYSTEM (1913-15)

BATTERY.—Battery is 6 volt, 80-100 ampere-hour. The two-wire system is used, or the positive (+) terminal is grounded.

STARTER.—Starter is connected to the engine through a Bendix drive, or by a pinion shifted by the operator.

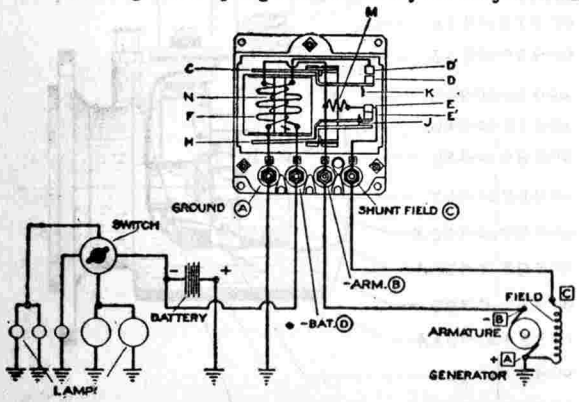
OILING.—Put 3 or 4 drops of light engine oil in the starter oilers every month. Repack bearing cups with vaseline every three months.

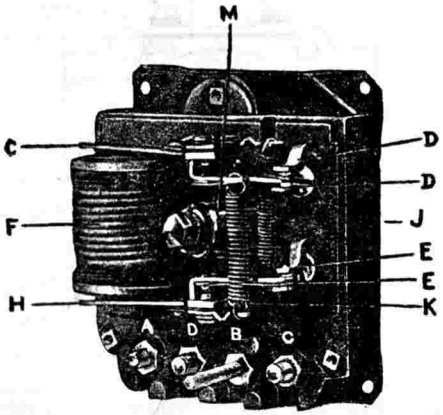
GENERATOR.—Generator current regulation is by vibrating regulator. Maximum current output is 10 amperes, reached at 15 miles per hour.

OILING.—Put 2 or 3 drops of light engine oil in the generator bearing oilers every month. If the car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles. Thoroughly clean out the bearings and repack with soft cup grease every six months.

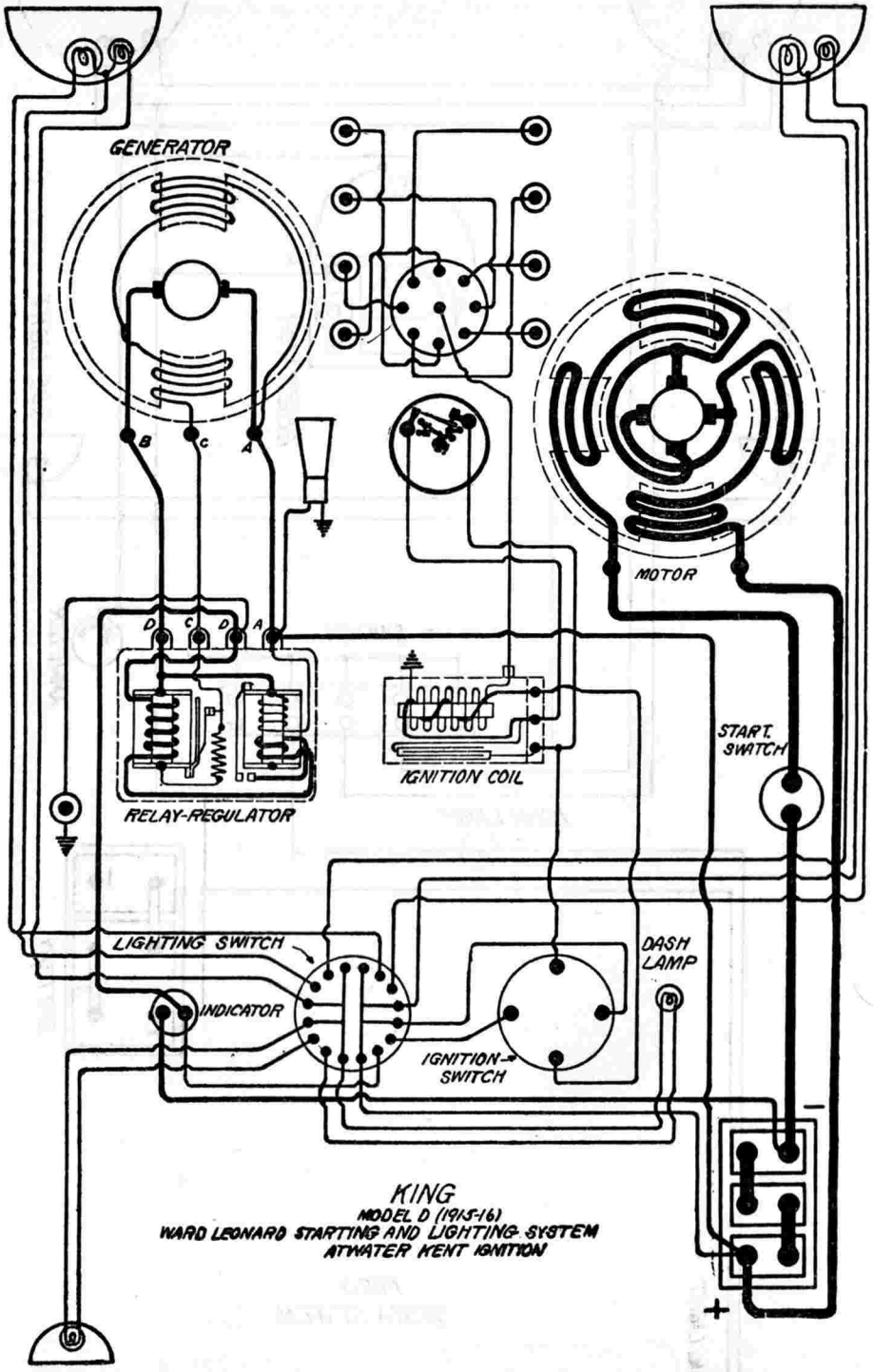
CONTROLLER OPERATION.—The fine winding of the electro magnet (F, Plate No. 186A) is connected across the brushes of the generator. When the voltage of the generator reaches a value greater than the voltage of the battery, the relay armature (C) is attracted by the core of the electro-magnet (F), which closes the contacts (DD) and completes the circuit between the generator and the battery. The electro-magnet also exerts an attraction on the regulator armature (H). When the current through the heavy winding of the electro-magnet reaches 10 amperes the regulator armature moves toward the core, opening the contacts (EE). The shunt field current, which heretofore passed through the contacts (EE), must now take the path through the resistance coil (M). The shunt field current is reduced, due to the increased resistance, and the magnetic field, voltage and current output of the generator are in turn reduced. The electro-magnet (F) then is not strong enough to hold the armature (H) against the tension of the spring (K), and the contacts (EE), close. The current output increases until the contacts again open. This cycle of operations is repeated rapidly, as the armature (H) vibrates, and maintains a constant current output at all speeds higher than that at which the regulator commences to operate. In the type CD controller, the resistance coil (M) is mounted above the regulator, there being no other difference between Types CC and CD. Type E (Plate No. 186) is the same in operation as Types CC and CD, but uses a separate electro-magnet to operate the regulator armature.

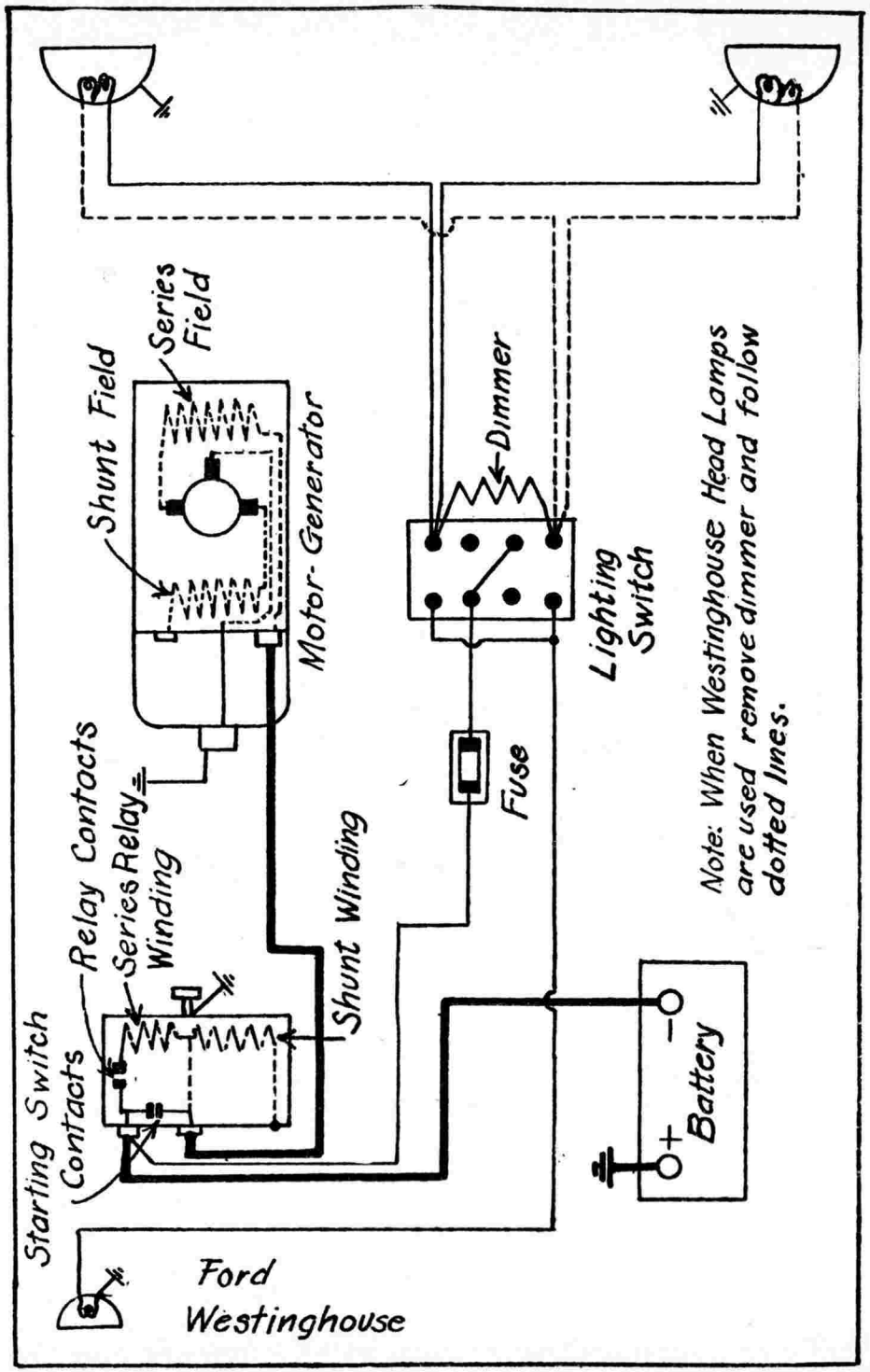
ADJUSTMENT AND CARE.—Relay contacts close at 8-10 and opens at 6-8 miles per hour. Both types are designed to limit the maximum current output of the generator to 10 amperes. The controller cover is sealed in place to prevent incompetent parties tampering with the adjustment. Clean relay and regulator contacts by drawing unglazed paper between them. If badly burned or pitted, resurface with well worn No. OO sandpaper. Remove all grit. Adjust before again putting into series. Relay and regulator sprng tension is adjusted by bending the brass supports.





WIRING DIAGRAM OF WARD LEONARD CONTROLLER





Ford

Westinghouse Starting and Lighting System

Battery.—Battery is 12 volt, 45 ampere-hour. The positive (+) terminal is grounded.

Ignition.—The standard Ford ignition or the standard Westinghouse ignition, with a special drive, may be used. Westinghouse breaker contacts should separate .006 inch to .008 inch. Should they become burned or pitted, resurface them with a fine, flat jeweler's file The springs should exert just enough pressure on the distributor brushes to force them ¼ inch past the top of the holder when the distributor cap is removed, but should retain them firmly so that they do not tend to fall out. Brushes must move freely in their holders. Be sure that both hrushes are in place when replacing the rotor. (There is a brush on both the top and bottom side of the rotor.)

Timing.—Contacts should begin to separate when the piston entering power stroke is on top dead center, spark control lever about three notches from the fully retarded position.

Firing Order.—The firing order is 1, 2, 4, 3.

Spark Plug Gaps.—Spark plug gaps should be .025 inch.

Ballast Resistor.—There is a ballast resistor in the ignition switch. In case it is necessary to operate the car with the ballast defective, a 5 ampere fuse may be used temporarily, but the ballast must be replaced as soon as possible, as continued operation without it will result in serious burning of the timer contacts.

Oiling.—Put several drops of light machine oil in the oiler at the side of breaker every month. If car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

Starter.—Starter-generator is chain connected to the engine crank shaft. Cold engine, heavy oil, tight bearings or damp, grounded or short circuited motor windings or commutator bars will cause low speed with excessive current during the cranking operation. Discharged battery, defective switch contacts, defective battery connections, defective motor connections, sticking brushes or dirty commutator or high mica will cause low speed and low current.

Oiling.—Put 5 or 6 drops of light engine oil in each of the starter-generator oilers every month. If car is driven more than 1000 miles in a month, the oiling must be done every 1000 miles.

Generator.—Generator current regulation is by third brush system. Relay is mounted in the starting switch. Relay should close at 9 miles per hour. Charging current should be 1 to 1.5 amperes at closing and .75 to 1.25 amperes at opening of contacts. Air gap between relay armature (moving member) and coil core should be .027 inch to .030 inch. Contacts should separate .013 inch to .017 inch. Adjust by bending the brass prongs. Clean contacts by drawing a piece of unglazed paper between them. If badly burned or pitted, resurface with a piece of well worn No. 00 sand paper, drawing a piece of unglazed paper between them, to remove all grit, before again putting into service.

Lamps.—Head lamps are 12-16 volts, 16 cp. Dimmer lamps (when used) are 12-16 volts, 6 cp. Dash lamp (when used) is 12-16 volts, 3 cp. Tail lamp is 12-16 volts, 3 cp. All lamps have single contact base. Either the regular Ford head lamps with a dimming resistance or Westinghouse lamps with dimmer bulbs may be used.

Fuse.—Lighting fuse is 10 ampere.

AC FUEL PUMP

DESCRIPTION:—The AC Fuel Pump is a mechanically operated gasoline pump. The pump is mounted on the side of the engine block and is driven through a rocker arm by an eccentric cam on the camshaft. It supplies gasoline at a positive pressure directly to the float chamber of the carburetor. The gasoline flow is controlled entirely by the needle valve in the carburetor float chamber and by the speed of the car so that the operation of the pump is entirely automatic.

Two types of the pump, Series A and B, have been developed and are in use as standard equipment on 1929 car models. The principle of operation of the two types is similar although they differ in constructional details as shown in the illustrations.

OPERATION:—The shaft (G) which supplies power to operate the pump is ordinarily the camshaft of the engine. When the camshaft is rotated, the eccentric cam (H) causes the rocker arm (D) to move backward and forward. The movement of the rocker arm which is pivoted at (E) pulls down the pull rod (F) together with the pump diaphragm (A) which is bolted on the upper end of the pull rod between the cup shaped metal discs (B). This creates a vacuum in the pump chamber (M) which causes gasoline from the fuel tank at the rear of the car to enter the pump through the inlet (J) into the sediment bowl (K) through the filter screens (L) and the inlet valve (N) and fill the pump chamber. As the eccentric completes a revolution the rocker arm ceases to pull on the pull rod and the driving spring (C) forces the pull rod and diaphragm upward. This closes the inlet valve and opens the pressure valve (O) causing the gasoline to flow through the outlet (P) to the carburetor float chamber. When the carburetor bowl is filled and the float needle valve closes, the pressure of the gasoline backed up in the pump chamber is sufficient to hold the driving spring (C) compressed, holding the pull rod and diaphragm in its lowest position. The movement of the rocker arm which continues as long as the engine is running is absorbed by the linkage (T) in the Series A Pump and by the break or cam action of the rocker arm (R) which is made in two pieces on the Series B Model. The pump thus remains inoperative until sufficient gasoline has been used from the carburetor float chamber to allow the driving spring to force the pull rod upward again when the pump resumes operation. This spring (S) is used merely to keep the rocker arm in contact with the eccentric to eliminate noise and to take up the free motion of the linkage and rocker arm break.

TROUBLE SHOOTING:—Check faulty gasoline feed to engine which may be caused by defective pump, from the following table:

Insufficient fuel is delivered at carburetor starving engine and causing it to stop or lack power.

1. Leaky tubing or connections allowing gasoline to be lost or permitting air to be drawn in the system. Check gas line and connections and watch sediment bowl for air bubbles.
2. Bent or kinked tubing. This will obstruct gas line and prevent gasoline reaching pump.
3. Sediment bowl loose. This will destroy pump vacuum and interfere with pump action. Tighten the thumb nut under the bowl and examine cork gasket to make sure that it is in place and lies flat around upper rim of sediment bowl.
4. Dirty screen. This will obstruct gasoline flow. Remove sediment bowl, take out and clean screen.
5. Loose valve plug. This will destroy pump vacuum or cause gasoline leak. Examine plug gasket and tighten plug.
6. Defective valves. Remove valve plugs and valves. Wash valves in gasoline and examine. If warped or damaged, replace. Examine valve seat. Replace valves, making certain that spring is around lower end of valve plug and that valve is placed with polished side down. Use new cap gaskets if necessary.

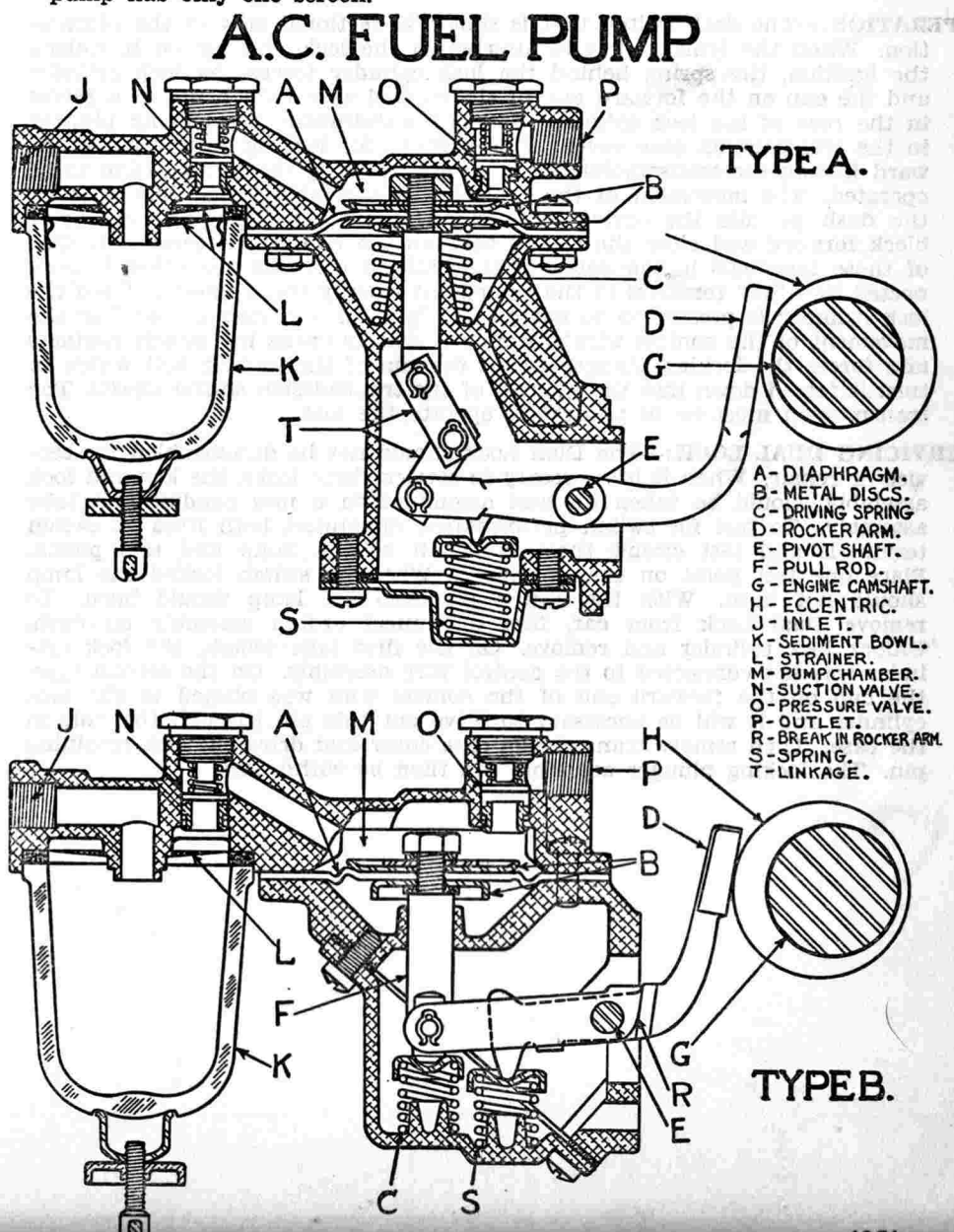
Gasoline leaks around Diaphragm.

Tighten the cover screws alternately and evenly. Do not disassemble pump body.

Carburetor Floods.

Check float needle valve for correct seating. Check float level.

SERVICING:—The AC Spark Plug Company, who manufacture these pumps, recommend that no attempt be made to disassemble the pump other than as described above as special jigs and fixtures are necessary to properly align parts to insure correct operation of the pump. The pump should be returned to them or to their service representatives whenever major repairs or adjustments are necessary. In ordinary installations these pumps are oiled by splash from the crankcase and no service adjustments are necessary other than to remove and clean the sediment bowl and filter screens occasionally. There are two screens on the Series A pump, one above and one below the cork gasket above the glass sediment bowl. The Series B pump has only one screen.

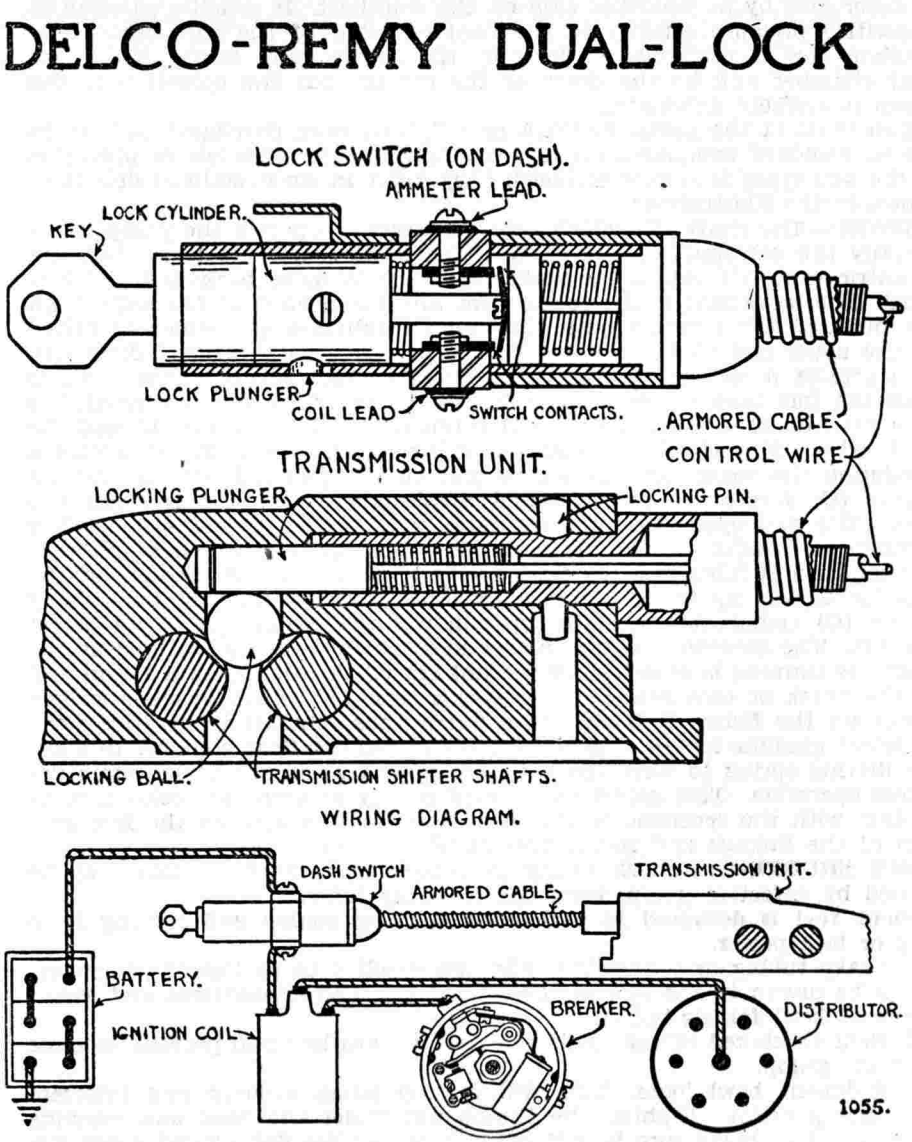


DELCO-REMY DUAL LOCK

DESCRIPTION:—The Delco-Remy Dual Lock is a co-incidental ignition switch lock and transmission lock. It consists of an ignition switch and lock mounted on the dash and connected through a flexible control wire with a transmission lock on the transmission case cover. The control wire is protected by an armored steel cable throughout the entire distance between the dash switch and the transmission. This makes it impossible to tamper with the lock action and prevents operation of the tranmission with the switch locked. The ignition switch is fitted with a tumbler lock and acts as a straight ignition switch connected between the battery and the ignition coil.

OPERATION:—The dash switch unit is shown in sectional view in the illustration. When the ignition key is inserted in the lock and turned to unlock the ignition, the spring behind the lock cylinder forces the lock cylinder and the cup on the forward end of the control wire (which fits in a recess in the rear of the lock cylinder) forward withdrawing the locking plunger in the transmission case cover. This permits the locking ball to move upward freeing the transmission shafts and permitting the transmission to be operated. The movement of the control wire assembly in the lock case on the dash permits the spring behind the contacts to force the contactor block forward and close the circuit between the two switch terminals. One of these terminals is connected to the ignition coil and the other is connected to a 'hot' terminal in the car circuit usually the ammeter. When the lock cylinder is pressed in to cut off the ignition and stop the engine, the movement of the control wire assembly positively opens the switch contacts and forces the locking plunger across the top of the locking ball which in turn is forced down into the grooves of the transmission shifter shafts. The transmission must be in neutral to operate the lock.

SERVICING DUAL LOCK:—The Dual Lock should not be disassembled for service or repair. When it is necessary to service these locks, the key and lock assembly should be taken off and assembled in a new conduit and tube assembly. To test for switch performance, disconnect both lines at switch terminals and test circuit through switch with a lamp and test points. Place one test point on each terminal. With the switch locked the lamp should not burn. With the switch unlocked the lamp should burn. To remove Dual Lock from car, first disconnect switch assembly on dash. Unlock lock cylinder and remove. On the first type switch, the lock cylinder was not connected to the control wire assembly. On the second type, the cup on the forward end of the control wire was pinned to the lock cylinder and it will be necessary to drive out this pin through the hole in the case. Then remove transmission case cover and drive out lock retaining pin. The locking plunger assembly can then be withdrawn.



DELCO-REMY ELECTROLOCK

DESCRIPTION:—The Electrolock is an ignition switch mounted on the dash and connected to the distributor housing terminal through an armored steel cable. The breaker lead from the coil is taken through the switch and then to the distributor through this cable which is fastened to the distributor by a special non-removable clip connection. The breaker is grounded through the switch case when the switch is in the 'Off' position. This absolutely prevents tampering with the car when the ignition is locked since it is impossible to wire around the switch.

OPERATION:—The dash switch consists of a tumbler lock cylinder mounted directly in front of a spring in the lock case. The switch contact is mounted on the rear of the lock cylinder. When the key is inserted in the lock and turned to the right as far as possible, the lock is released and the lock cylinder is forced out by the spring closing the switch contacts and breaking the ground connection. The key may then be removed. To turn off the ignition, the lock cylinder is pressed in. This opens the switch, grounds the distributor and locks the ignition. It is only necessary to make certain that the lock cylinder remains in the 'In' position and that the lock has snapped. This feature makes it impossible for the driver to neglect to lock the switch.

TROUBLE SHOOTING:—To test the Electrolock for possible ignition trouble, first disconnect wire on Electrolock case leading to coil. Turn the distributor shaft until contacts open or block open contacts with a piece of cardboard or any insulating substance. Then make the following tests with a lamp and test points:

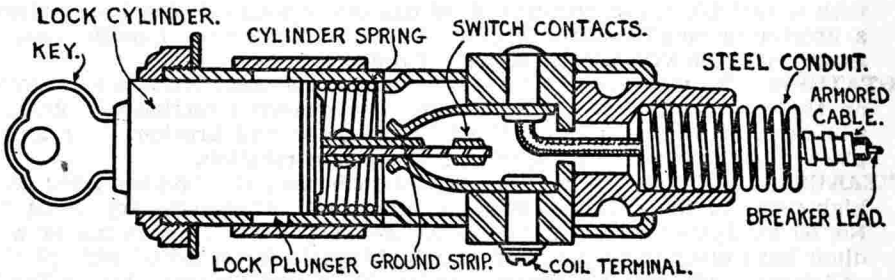
1. Place one test point on the terminal stud inside the distributor housing and place the other test point on the terminal on the side of the Electrolock case from which the coil lead was disconnected. With the switch unlocked the lamp should burn. With the switch locked the lamp should not burn.

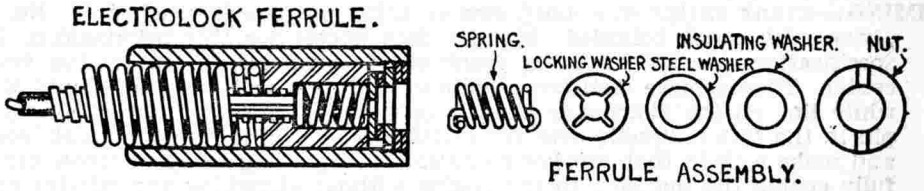
2. Place one test point on the distributor terminal stud as in test (1) and place the second test point on the switch case. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If the lamp burns with the switch unlocked the condenser may be shorted or grounded. Disconnect the condenser and repeat the test. If these tests indicate Electrolock is operating satisfactorily, check coil, breaker contacts, distributor, spark plugs and wiring. If tests indicate trouble in Electrolock, disassemble as directed in the following paragraph:

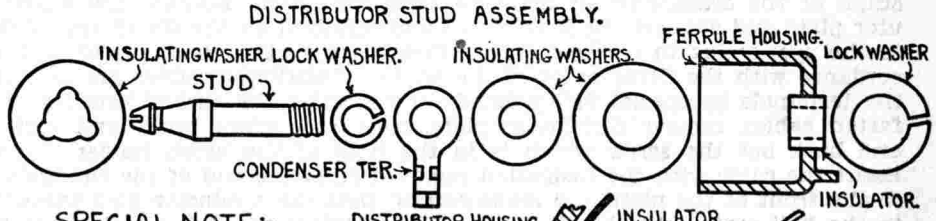
DISASSEMBLY OF ELECTROLOCK:—Remove mounting nut with a spanner wrench and remove switch assembly from dash. Then unlock the switch and depress the plunger in the elongated slot in the side of the case. Then remove the contact assembly and inspect. In reassembling switch make certain that the retainer washer which holds the lock return spring in position does not touch either of the switch contacts. Assemble contact assembly so that the small tang on the side next to the lock cylinder is opposite the terminal screw. The tang fits into a hole in the lock cylinder. If the contact assembly is not replaced correctly the battery will be grounded when the switch is in the 'Off' position.

SERVICING DISTRIBUTOR:—To remove the distributor to the bench for service, remove the Electrolock from the dash and remove distributor from the engine as directed on the car data sheet. Then take entire distributor and Electrolock off the car. To remove Electrolock from the distributor, use special Electrolock wrench Part No. 829034 to remove square nut on terminal stud inside the distributor housing. On the Chevrolet distributor (on which this type Electrolock is standard equipment), it will first be necessary to turn the distributor shaft until advance weight mounting plate studs are 90 degrees from terminal stud, remove the three screws mounting the breaker plate and tilt the breaker plate down on the side nearest the terminal stud. The breaker arm must be slid up on the pin at the same time. Then remove the square nut and pull the Electrolock cable and stud assembly straight out. To remove the stud from the cable, use the special wrench to loosen the retainer nut in the end of the ferrule. A new locking washer must be used in reassembling. The various parts of the ferrule and stud assembly are illustrated in proper positions. Assemble these parts in order as shown. It will be necessary to remove the Electrolock from the distributor to replace the condenser and it is advisable also in replacing breaker arms.

DELCO-REMY ELECTROLOCK







SPECIAL NOTE:-

Electrolock Ferrule Assembly and Stud Assembly on Distributor housing must be made exactly as shown. The square nut must be taken off inside Distributor housing before stud can be released from ferrule. A new locking washer must be used in reassembling. A special wrench (illustrated at right) must be used to release stud in Ferrule.

1053.

SPECIAL WRENCH.

PART NO. 829034.

EISEMANN MAGNETO

TYPES GS-4 AND GS-4/2. FOUR AND TWO CYLINDER TYPES

DESCRIPTION:—The Eisemann Magneto, Type GS-4 and GS-4/2, is of the armature type. The shuttle wound armature is carried on ball bearings which are insulated from the frame. The armature is grounded through a special ground brush in the base so that no current flows through the shaft bearings. A single 'U' shaped magnet is mounted directly above the armature. The GS-4 magneto is designed for four cylinder engines and should be driven at crankshaft speed on four cylinder four cycle engines and at twice crankshaft speed on four cylinder two cycle engines. The GS-4/2 magneto is designed for two cylinder engines and should be driven at crankshaft speed on two cylinder four cycle engines. Magnetos are fitted with drilled and tapped base plates for base mounting and can also be mounted by a mounting strap of brass or a non-magnetic metal if dowel pins are used in the base to hold the magneto rigid. The base mounting bolts must not enter the base of the magneto more than 5/16 inch or they will bottom in the holes, distorting the magneto frame. Magneto is regularly furnished with a variable spark advance of 30 degrees. Special timing levers allowing a greater or smaller advance can be secured for special installations. The magneto is likewise furnished with fixed spark.

ROTATION:—The magneto can be driven in only one direction which is stamped on the drive end plate. If it is desired to change direction of rotation, it will be necessary to remove the breaker plate and breaker lever and replace with similar units designed for opposite rotation.

BREAKER:—Breaker contacts separate .012 inch with the breaker lever on the high point of the cam. Resurface contacts whenever necessary, using worn No. 00 sandpaper on platinum points and a fine flat contact file or a medium hard oilstone on tungsten points. Magneto is furnished with platinum or tungsten contacts for special service. To adjust contacts, loosen the lock nut on the stationary contact stud and turn up the stud until the correct gap is secured.

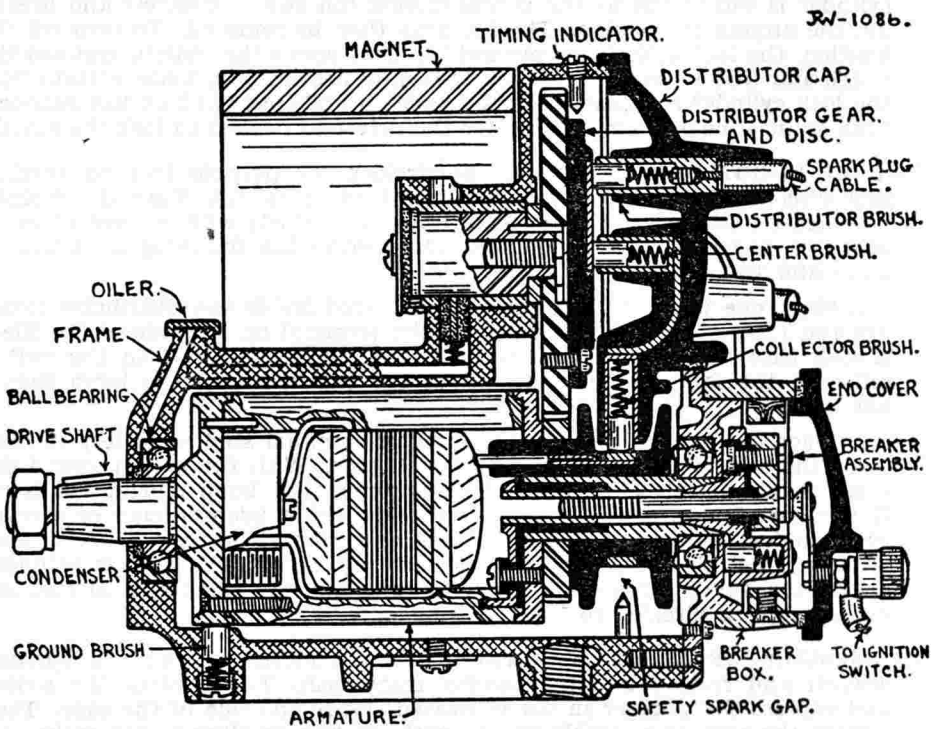
TIMING:—Crank engine over until correct firing position is reached for No. 1 piston with spark retarded. See car data sheets for this information. If specifications are not available, crank engine until piston reaches top dead center. Then remove distributor plate on magneto and turn shaft until the white line on the distributor plate is opposite or directly under the timing pin in the frame directly over the distributor gear. Fully retard spark lever and make certain that breaker contacts are beginning to open. Then carefully couple the magneto to the engine without disturbing the relative position of the crankshaft or magneto armature shaft. Replace the distributor plate and connect the lower left hand terminal on the distributor plate to the spark plug in cylinder No. 1. Connect the other spark plugs in accordance with the firing order of the engine. Distributor cables are held in the terminals by special ball pointed screws under the carbon brushes. To fasten cables, remove distributor plate, take out carbon brush and spring and back out the screw which is in the base of the brush holder. Then insert the cable with the insulation removed from the end of the conductor, in the front of the plate and make certain that the conductor goes through to the ball seat in the brush holder. Then replace the screw and check to see that the cable is firmly held in place.

OILING:—Oil wells are provided at each side of the distributor plate at the breaker end of the magneto. One of these oilers should be given one drop of oil every 1000 miles or 100 hours of operation. Both oilers oil the same bearing and only one need be used. The oiler at the drive end of the magneto should be given 15 drops of light machine oil every 1000 miles or each 100 hours. Carefully clean the entire breaker mechanism with gasoline occasionally and wipe out the inside of the distributor plate. Do not use sandpaper on the brush track of the distributor disc.

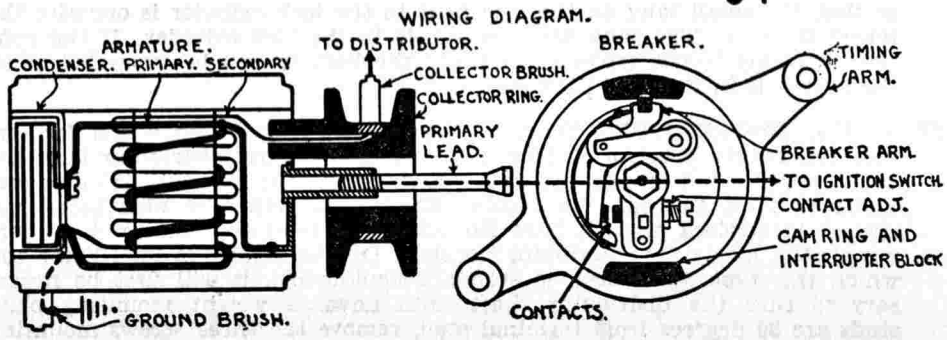
SPARK PLUGS:—Spark plugs should be set at 1/64-1/32 inch, depending on the compression ratio of the engine. A safety spark gap of 8 MM. is provided by the pointed set screw mounted directly under the collector ring on the breaker end of the magneto.

WIRING:—The terminal on the breaker cover should be connected to the ground switch. The magneto can be furnished with a special short circuiting end cap which short circuits the magneto in the fully retarded position.

IMPULSE COUPLINGS:—Couplings provided for connecting magneto to engine are of the 'Oldham' type. The self-aligning feature depends upon a certain amount of play between the floating disc and the coupling members. This clearance should be 1/64 inch. Two types of impulse starters are furnished for these magneto types. The Type IS-2 open type impulse starters can be used on all magnetos manufactured since 1916. The Type IS-5 enclosed type is adaptable to all magnetos produced since 1926. Impulse starters require no lubrication. An impulse starter having a lag angle 5 degrees greater than the timing range of the magneto should be used. The lag angle of the impulse starter used on fixed spark magnetos should be equal to the number of degrees ahead of top dead center at which the engine is timed.



EISEMANN MAGNETO -Type GS-4.



EISEMANN MAGNETO

TYPE GS-6. SIX CYLINDER TYPE

DESCRIPTION:—The Type GS-6 Magneto is of the high tension shuttle wound armature type. The rotating armature is carried on ball bearings which are insulated from the frame. The armature is grounded through a special ground brush mounted in the base plate at the drive end of the magneto. This prevents any current flow through the armature bearings. A single 'U' shaped magnet is mounted directly above the armature. The GS-6 Magneto is designed for use on six cylinder four cycle low or medium compression engines and should be driven at 1½ times crankshaft speed. It is furnished with a 30 degree timing range for variable ignition although special timing ranges are furnished and magneto can be equipped for fixed ignition. The base plate is drilled and tapped for base mounting bolts. It may likewise be strap mounted with a brass or other non-magnetic mounting strap if dowel pins are used in the base to provide alignment.

ROTATION:—The magneto is designed to be driven only in the direction of rotation stamped on the oil well cap on the drive end of the magneto. In order to change the direction of rotation, it is necessary to disassemble the magneto and replace the breaker plate and breaker lever with units designed for opposite rotation.

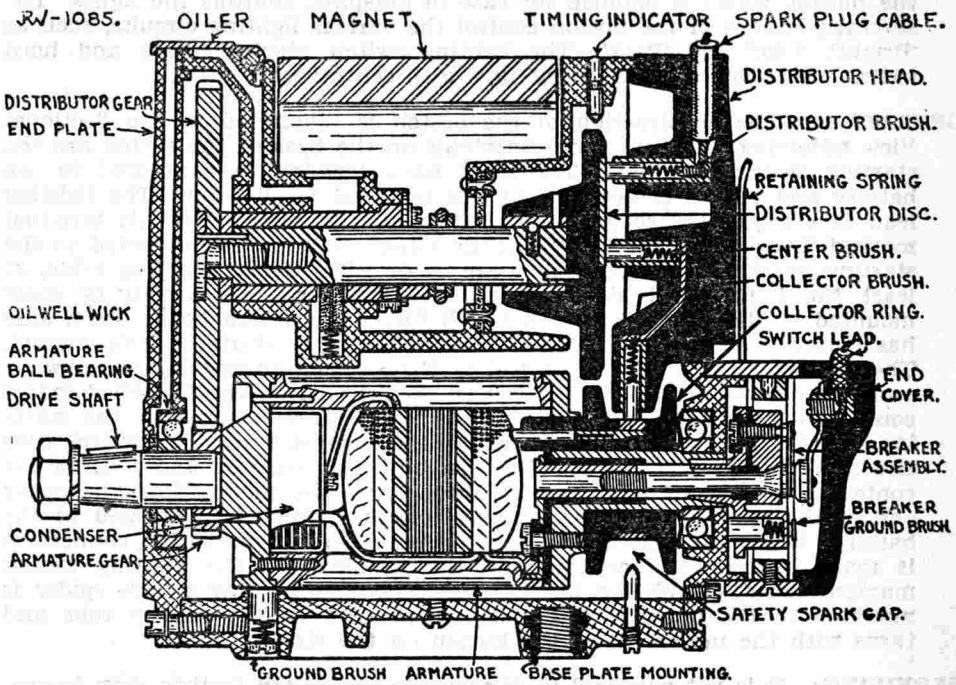
BREAKER:—Breaker contacts separate .012 inch. Set contact gap by loosening the lock nut on the stationary contact mounting stud and turning up the stud until the correct gap is secured with the fiber bumper of the breaker arm on the high point of the cam. Resurface contacts when necessary with a fine flat contact file. Platinum contacts are furnished as standard equipment.

TIMING:—Crank engine over until correct firing position for piston No. 1 is reached. See car data sheets for this information. If specifications are not available, crank engine until piston No. 1 reaches top dead center entering power stroke. Fully retard magneto timing lever. Remove distributor plate and turn magneto shaft until the indicator mark on the distributor disc is directly under the set screw in the housing above the disc. Breaker contacts should begin to open at this point. Carefully connect the magneto to the engine without disturbing the relative positions of the armature shaft and crankshaft. Connect the extreme left hand terminal of the distributor plate to the spark plug in cylinder No. 1. Connect the remaining spark plugs in accordance with the firing order of the engine. Distributor cables are held in place by set screws in the carbon brush holders under the brushes. To fasten cables, remove distributor plate, remove carbon brush and spring and back out set screw. Then strip insulation from end of cable, twist the stranded wire tightly together and insert in the proper terminal and tighten the set screw.

OILING:—Oil wells are provided at each side of the distributor plate directly behind the timing lever. These oilers both oil the same bearing and only the most accessible one need be used. Put five drops of light machine oil in the oiler every 1000 miles. There are two oil holes under the oil well cap at the drive end of the magneto. Put 15 drops of oil in the larger oil well and five drops of oil in the smaller well every 1000 miles. Carefully clean the entire breaker mechanism and wipe out the distributor plate with gasoline whenever necessary. Carefully dry all parts before the magneto is again operated.

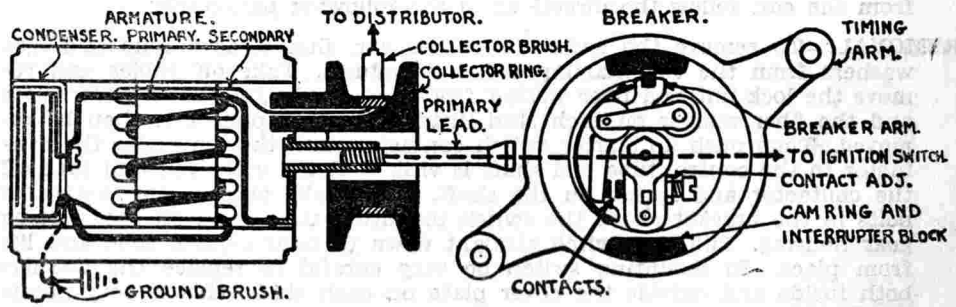
SPARK PLUGS:—Spark plugs should be set at 1/64-1/32 inch. This will depend largely on the compression ratio of the engine. A safety spark gap of 8 MM. is provided by the set screw in the base plate directly under the collector ring.

IMPULSE STARTER:—Impulse starter can be mounted on the GS-6 Magneto. Ordinary coupling is by 'Oldham' type couplings. The self aligning feature of these couplings depends on the clearance between the floating disc and the coupling members. This clearance should be 1/64 inch.



EISEMANN MAGNETO - TYPE GS-6.

WIRING DIAGRAM.



AID 'FINGER TIP' CONTROL

DESCRIPTION:—Finger Tip Control consists of a switch mounted on a bracket at the base of the steering gear operated by a single button located in the center of the steering wheel which is connected to the switch by a single tube running through the steering column. The horn is sounded in the usual manner by depressing the button. Pulling up on the button closes the starting switch and permits the starter to crank the engine. Rotating the button, which is notched for ease in grasping, controls the lights. The several positions of the button control the various lighting circuits, such as 'Bright', 'Dim' and 'Park'. The lighting switch, starter switch and horn switch are thus combined in one unit with centralized control.

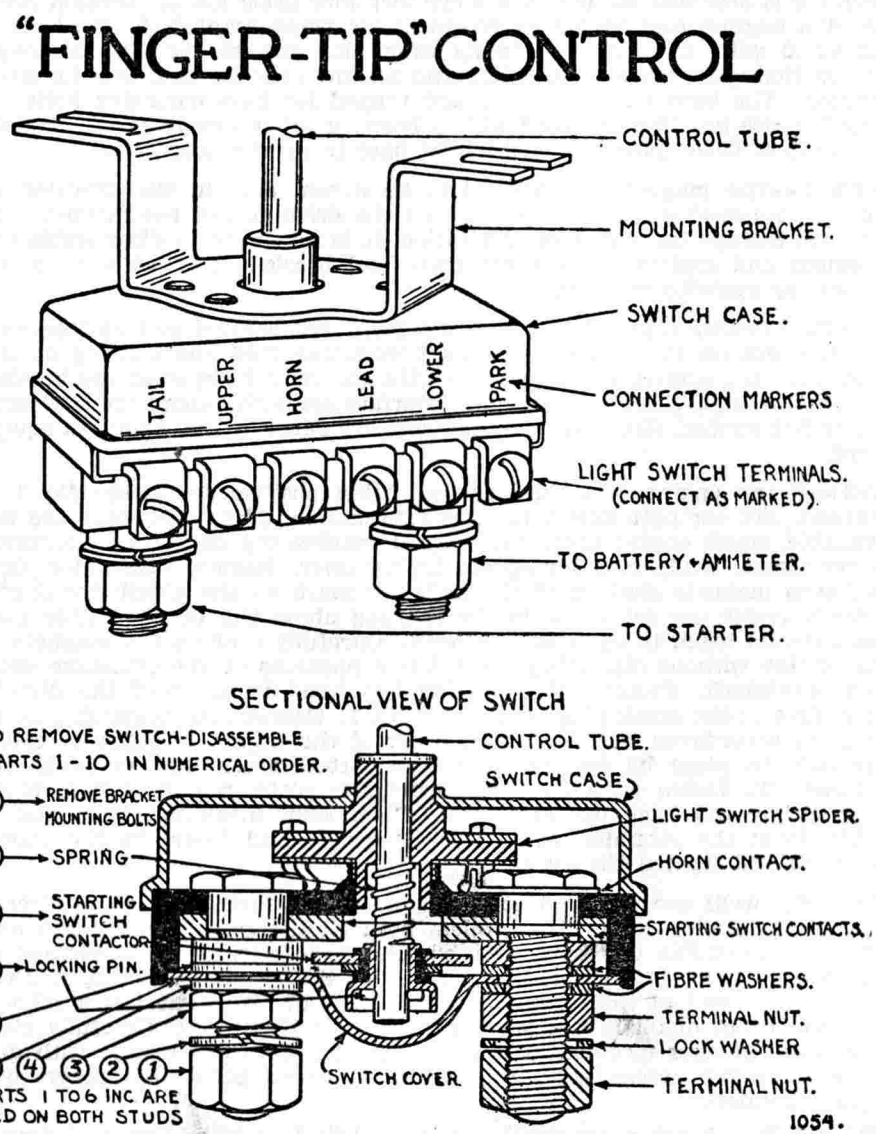
OPERATION:—The construction of the switch is illustrated in the Sectional View adjoining. The two large terminals on the base of the switch are the starting switch terminals. The right hand terminal is connected to the battery and a lead is taken from this terminal for lighting. The lighting lead is connected through the ammeter to the lighting switch terminal marked 'Lead'. The left hand starting switch terminal is connected to the starting motor. Both connections are made with regular starting cable, at least No. 1 flexible braided cable. The two terminals consist of studs mounted in the insulating block which forms the switch body. Each stud has mounted on it a copper block which forms the starter switch contact. The contactor mounted on the end of the steering column tube is directly under the two contacts. When the button on the steering wheel is pulled up this contactor is pulled up and connects the two contacts completing the starting circuit. The spring directly above the contactor on the control tube end shaft breaks the circuit when the button is released and returns the contactor to the 'Off' position. The horn contact is mounted on the upper end of the stud forming the starting terminal which is connected to the battery. When the button on the steering wheel is depressed a connection is made between the contact and the terminal on the lighting switch marked 'Horn', completing the horn circuit. The lighting switch spider is mounted in the upper part of the switch case on the control tube and turns with the movement of the button on the steering wheel.

SERVICING:—It is not practical to disassemble the switch further than is necessary to remove it from the steering gear mounting and the manufacturer recommends that no service work be attempted. Test circuits through the switch with a lamp and test points and when it is determined that the switch is defective the entire unit should be replaced. To remove switch from the car, follow the directions in the following paragraph:

REMOVAL:—To remove the switch from the car, first remove nuts and lock washers from the two starting switch terminals. Take off cables and remove the lock nut and fiber washer from each stud. The switch cover plate and the fiber washer on each stud inside the cover plate can then be removed. Then push up starter switch contactor until the pin under the contactor in the control tube end shaft is visible. Remove the pin and take off the contactor and spring on the shaft. Then take out the cap screws or bolts in the bracket above the switch mounting the switch on the steering gear housing. Pull the switch straight down to clear control tube and lift from place. In mounting switch be very careful to replace the washers both inside and outside the cover plate on each stud. This is very necessary to prevent grounding the battery.

SERVICE PARTS OBTAINABLE
(Aid Mfg. Co., 2625 Stewart Ave., Chicago, Illinois)

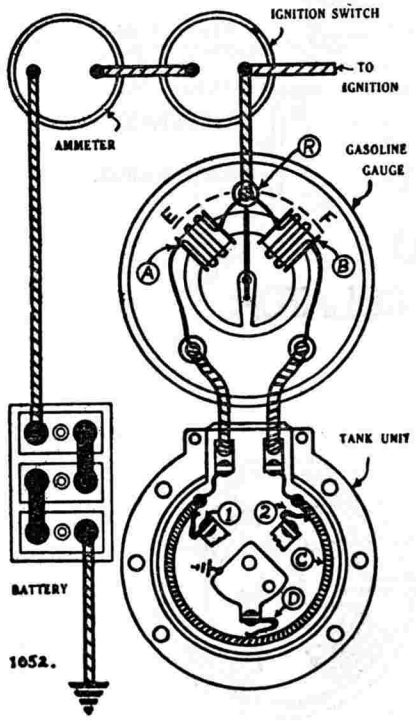
Part No.	Description
311	Complete Switch Assembly (Willys Knight and Whippet Type).
54	Switch Assembly, less Parts listed below:
5	Insulating Washer (4 used).
23	Switch Cover Plate (1 used).
29	Stud Lock Washer (2 used).
31	Contact Bar Pin (1 used).
34	Contact Bar Spring (1 used).
38	Stud Nut (4 used).
50	Contact Bar Assembly (1 used) (Contactor).
56	Switch Tube End Lower Shaft.



NECO GASOLINE GAUGE

DESCRIPTION:—The Neco Gasoline Gauge consists of two units; a dash unit or recording gauge calibrated to read from 'Empty' to "Full" on which the amount of gasoline in the fuel tank is indicated by a movable pointer, and a tank unit mounted on the gasoline tank at the rear of the car which is actuated through a gear system by a float which rises and falls with the level of the gasoline in the tank. The two units are connected by two wires which are ordinarily included in the regular car wiring harness. In addition the dash unit is connected to the coil side of the ignition switch or to the switch side of the ignition coil so that current is supplied to the gauge whenever the car is in operation. The gauge will not indicate the amount of gasoline in the tank when the ignition is turned off but if a reading is desired the ignition may be turned on momentarily. The tank unit is grounded through the mounting. The dash unit is not grounded.

OPERATION:—The gauge is essentially a current balancing device. The two coils 'A' and 'B' are both connected to the current source at the terminal 'R'. Each coil is in series with a portion of the resistance coil 'C' in the tank unit and is grounded through the moving contact 'D'. There are thus two independent circuits connected to a common current source. For this reason variations in battery voltage have no effect on the operation or accuracy of the gauge. The moving contact or brush 'D' is connected through a gear system to the float in the gasoline tank. When the tank is empty and the float at its lowest position, the contact 'D' will be in position '1'. At this point the resistance will be entirely cut in the circuit of coil 'B' and entirely out of the circuit of coil 'A'. Due to the lower resistance of the coil 'A' circuit, the coil will draw a relatively larger current than coil 'B' and the movable vane or armature will be drawn into coil 'A' and away from coil 'B'. The pointer is affixed to this vane and will consequently move to the extreme left or empty position opposite the dial figure 'E'. When the gasoline tank is full the contact 'D' will have moved to position '2' and the conditions will have been reversed so that the vane will be drawn into coil 'B' and the pointer will be in the full position opposite the dial figure 'F'.



MOUNTING:—It is very important in mounting the tank unit that all paint and grease be removed from the edges of the tank so that a good ground is secured between the unit and the frame. The wiring must be made exactly as shown. If the wires are reversed the gauge readings will be reversed. It will not be necessary to ground the dash unit and it can be mounted on a wooden dash.

TROUBLE SHOOTING:—There are no service adjustments as all resistances and parts assemblies are absolutely fixed. If the gauge is properly installed and registers correctly, no attention is required. If the gauge does not register correctly, check trouble from the following trouble shooting table:

Gauge does not register. Pointer assumes any position regardless of gasoline level in tank.	1. Open circuit in line from gauge to battery. Test for current at gauge terminal. 2. Tank unit is not grounded. Carefully ground tank unit to tank or car frame.
Gauge registers 'Empty' under all conditions.	Open circuit in line between coil 'B' and tank unit. Connect these terminals of dash and tank unit with a jumper outside car wiring harness.
Gauge registers from 'Empty' to '½' full only as tank is filled.	Ground in line between coil 'A' and tank unit. Disconnect this line at both ends and connect a jumper outside the car wiring harness.
Gauge registers '½' with tank empty and 'Full' with tank full.	Ground in line between coil 'B' and tank unit. Disconnect line at both ends and connect a jumper outside the car wiring harness.
Gauge registers '½' at all times with tank unit connected and has no definite reading when disconnected.	Short circuit in lines between dash unit and tank unit. Disconnect both lines and connect jumpers between the units outside the car wiring harness.
Gauge registers 'Full' at all times.	Open circuit in line between coil 'A' and tank unit. Disconnect line and connect jumper outside car wiring harness.
Gauge readings are reversed registering 'Full' when tank is empty and 'Empty' when tank is full.	Connections reversed at dash unit or tank unit. Connect lines correctly and check gauge readings.

If these tests indicate that either the dash unit or tank unit is defective the unit should be returned to the manufacturer for repair. It is not practical to attempt repairs and parts are not furnished for replacement.

OWEN-DYNETO BATTERY CHARGE REGULATOR

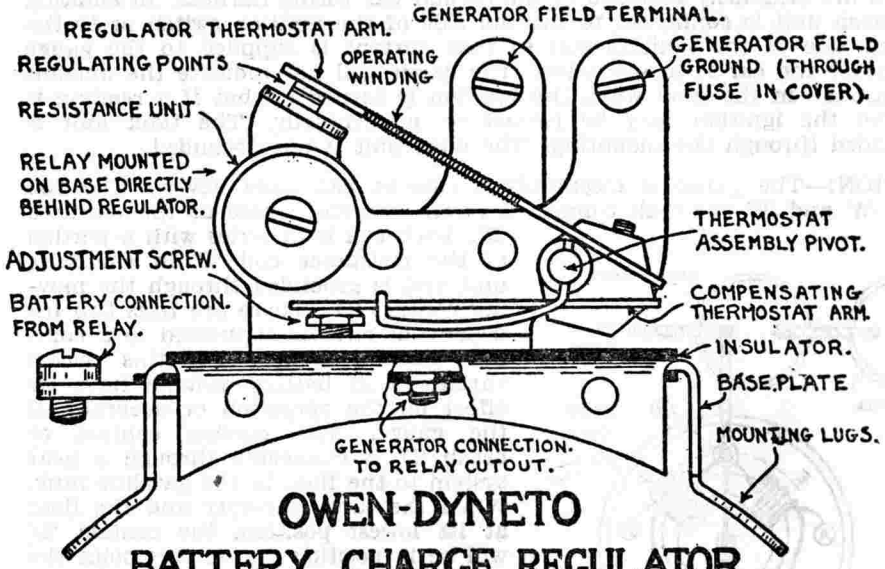
DESCRIPTION:—The Owen-Dyneto Battery Charge Regulator consists of an electrically operated thermostatic regulator and a relay cut-out mounted in a single case which is designed to be mounted on top of the generator. It is standard equipment on certain models of Owen-Dyneto generators and can be installed on generators of other manufacture by making minor alterations in the relay mounting and wiring hookup. The regulator permits a relatively high charging rate without danger of damaging the battery and automatically varies the charging rate to cover different driving conditions by permitting the high charging rate over short periods of time or for short trips and automatically cutting down the rate after the regulator thermostat heats up which will occur on long trips or after the generator has nearly completed the battery charge.

OPERATION:—The regulator consists of two thermostat arms mounted on a pivot. The upper arm carries the regulator contacts and has a fine resistance unit wound on it. This resistance is connected directly between the generator relay terminal in the base of the unit and ground and is thus connected directly across the main brushes of the generator. The lower thermostat arm is a compensating unit and carries no winding. It is designed to compensate the regulator for temperature changes. The spring which normally keeps the regulator contacts closed engages the lower thermostat arm. The two upper terminals of the regulator should be connected to the field as marked in the illustration. The field resistance is wound on a spool on the regulator frame and is connected between the two regulator terminals and across the contacts. It is thus connected in series with the generator field winding but is short circuited by the regular contacts when the contacts are closed.

In operation with the regulator contacts closed the generator operates as a straight third brush shunt machine charging the battery at the rate determined by the third brush setting. Current likewise flows through the winding on the upper thermostat arm. When the generator voltage reaches 8 volts (cold) or 7.5 volts (hot) this winding heats up causing the arm to flex and open the contacts which inserts the resistance in the field circuit. This reduces the charging rate to the finish rate of the battery.

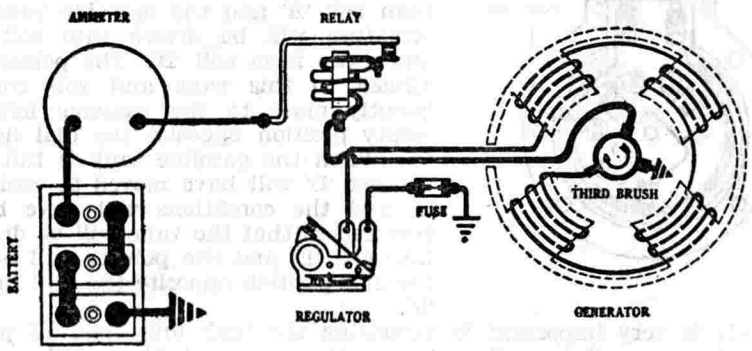
ADJUSTMENT:—The regulator is set at the factory and should not require adjustment. However, if adjustment is necessary, connect a voltmeter between the battery terminal of the generator and ground and operate the generator for several minutes to allow the thermostat winding to heat. The regulator cover must be in place or the air blast of the fan will prevent the proper functioning of the thermostat. Then turn the adjusting screw under the lower thermostat arm clockwise to increase the operating voltage and counter-clockwise to decrease the voltage. The regulator should operate at 8.0 volts cold or 7.5 volts hot.

INSTALLATION:—The regulator can be installed on practically any generator after removing the old relay cutout and modifying the old relay mounting to take the regulator mounting screws. Then connect the old relay lead from the generator main brush to the terminal in the base of the regulator unit. Disconnect the generator shunt field ground and bring this lead out of the generator, drilling a hole through the commutator cover band to take the wire. Connect this lead to the regulator field terminal. The other regulator terminal should be grounded through the fuse mounted in the regulator cover. On Owen-Dyneto generators or generators with the field grounded through a fuse mounted on the generator frame, the field should be disconnected from the fuse terminal and brought out to the regulator and a second lead should be brought out from the fuse terminal to the regulator ground terminal. On generators with the field grounded through a thermostat, it will be necessary to take off the resistance connected across the thermostat contacts and then render the thermostat inoperative by bending one arm back so that the contacts are permanently open.



OWEN-DYNETO BATTERY CHARGE REGULATOR

WIRING DIAGRAM.



OWEN-DYNETO 'LAMP CONTROL' GENERATORS

TYPES CD-836, CD-839, CD-846

DESCRIPTION:—The Owen-Dyneto Lamp Control Generator is designed to deliver a set amount of current to the battery regardless of the load on the generator. It will charge the battery at pratically the same rate whether the car lamps are burning or not. It is a compound wound machine with two shunt coils wound on opposite poles and connected between the third brush and ground through a five ampere field fuse. There are two main brushes, one being grounded and a lead from the other being taken out to the relay cutout and then to the battery. A series field is wound on the other two field poles. This field is connected in series with the lamp load through a 15 ampere fuse mounted on the generator field frame and consists of two coils in series with each other. This field circuit is open with the lamp switch off.

OPERATION:—With the lamp switch 'Off' and lamps not burning, the generator operates as a third brush shunt wound generator with two field coils and 'consequent' poles between the field poles which are energized. When the lamp switch is turned on the lamp circuit current which is taken from the battery side of the generator relay cutout flows through the 'series' windings strengthening the field and increasing the generator output in proportion to the current drawn by the lamps. The 15 ampere fuse in the lighting circuit is designed to prevent overload and the lamp load should be so regulated as to keep the current below this figure. The ignition current should never be taken through the generator and the coil lead should be connected directly to the generator side of the ammeter.

PERFORMANCE:—The generators are set at the factory to give the following performance:

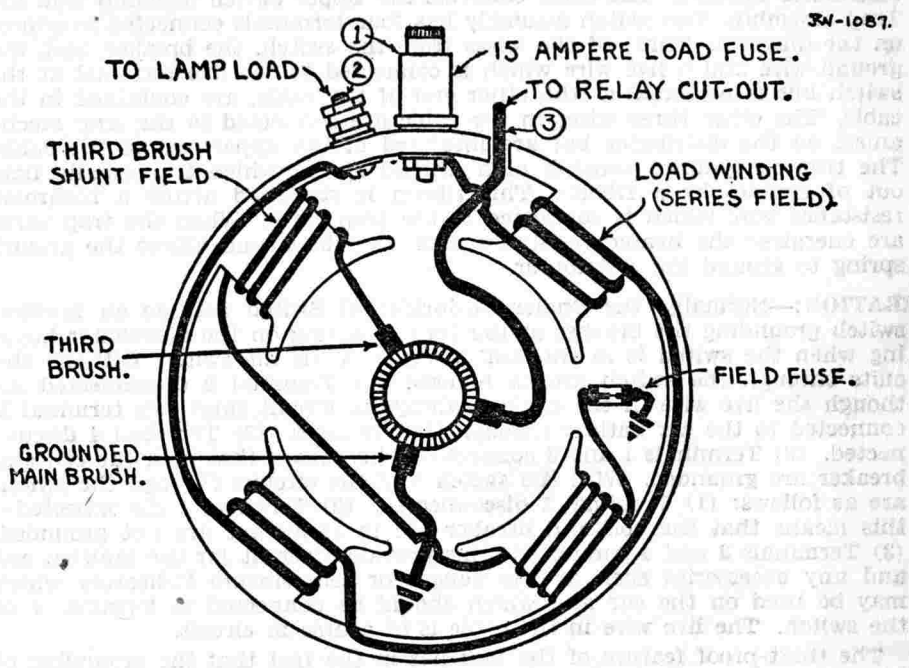
Generator Data

Load	Amperes	Volts	R.P.M.
Without Lamp Load.	0	12.4	1200
With Lamp Load.	0		900
Without Lamp Load.	7		2320
With Lamp Load.	4		1800
Without Lamp Load.	6		3200
With Lamp Load.	1		3200

The above table indicates current supplied to the battery by the generator at various speeds and under different conditions. The maximum output of the generator is 15 amperes. The normal lamp load is approximately 11 amperes.

ADJUSTMENT:—The third brush setting is adjustable. To adjust third brush, remove the commutator end cover and turn the slotted shifter shaft on the generator end plate.

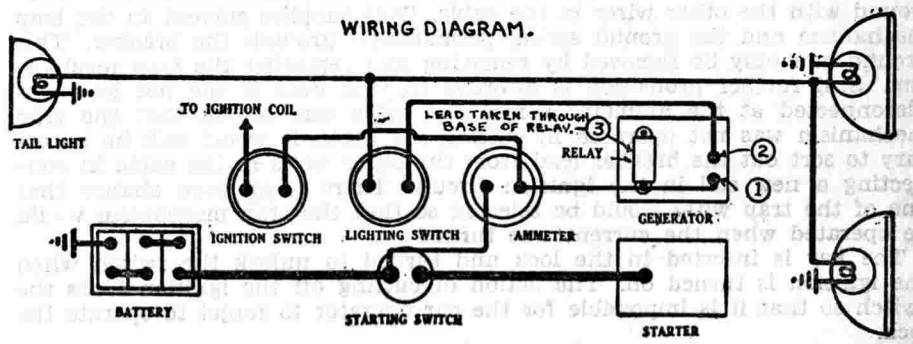
RELAY:—**Type 20070.** Relay is mounted on the generator. Relay contacts close at 900 R.P.M. with lamp load and 1200 R.P.M. without lamp load when the generator voltage reaches 12.4 volts.



OWEN-DYNETO GENERATOR

Types CD-836,838,839,846.

WIRING DIAGRAM.



SHALER CO-INCIDENTAL IGNITION LOCK

DESCRIPTION:—The Shaler Co-incidental Ignition Switch consists of an upper assembly composed of the lock cylinder and ignition switch of molded bakelite enclosed in a pressed steel case, a cable containing six conductors all insulated from each other, and a trap assembly mounted on the side of the distributor housing. The cable connects the Upper switch assembly and the Trap assembly. The switch assembly has four terminals connected as shown on the diagram. Three of the wires from the switch, the breaker lead, the ground wire and a live wire which is connected to the live terminal at the switch but is insulated at the other end of the cable, are contained in the cable. The other three wires in the cable are connected to the trap mechanism on the distributor but are insulated at the upper end of the cable. The trap mechanism consists of a ground spring which is normally held out of contact by a ribbon. This ribbon is stretched across a nichrome resistance wire which is connected to the trap wires. When the trap wires are energized the heated resistance cuts the ribbon and allows the ground spring to ground the distributor.

OPERATION:—Normally, the Shaler Co-incidental Switch acts as an ignition switch grounding the breaker at the trap mounting on the distributor housing when the switch is in the 'Off' position. With the switch 'Off' the circuits through the switch are as follows: (1) Terminal 2 disconnected although the live wire in the cable is always in circuit since this terminal is connected to the car battery through the ammeter. (2) Terminal 4 disconnected. (3) Terminals 1 and 3 connected—this means that both the coil and breaker are grounded. With the switch 'On' the circuits through the switch are as follows: (1) Terminal 1 disconnected. (2) Terminal 3 disconnected—this means that the coil and breaker are in series but are not grounded. (3) Terminals 2 and 4 connected—this provides current for the ignition coil and any accessories such as gas gauges or temperature indicators which may be used on the car and which should be connected to terminal 4 of the switch. The live wire in the cable is of course in circuit.

The theft-proof feature of the lock lies in the fact that the grounding of the breaker and coil occurs at the distributor and cannot be relieved by disconnecting the switch assembly at the dash. This means that the cable must be cut. However, in cutting the cable contact is certain to be made between the live wire and one or more of the trap wires which are interwound with the other wires in the cable. This supplies current to the trap mechanism and the ground spring permanently grounds the breaker. This ground can only be removed by removing and replacing the trap mechanism. Still further protection is afforded in that even if the hot lead was disconnected at the ammeter before the cable was cut so that the trap mechanism was not operated in cutting the cable, it would still be necessary to sort out the breaker lead from the other wires in the cable in connecting a new coil in the ignition circuit. There is an even chance that one of the trap wires would be selected so that the trap mechanism would be operated when the current was turned on.

The key is inserted in the lock and turned to unlock the switch when the ignition is turned on. The action of cutting off the ignition locks the switch so that it is impossible for the car operator to forget to operate the lock.

TROUBLE SHOOTING:—To test Shaler Lock for ignition trouble, use a lamp and test points and make the following tests:

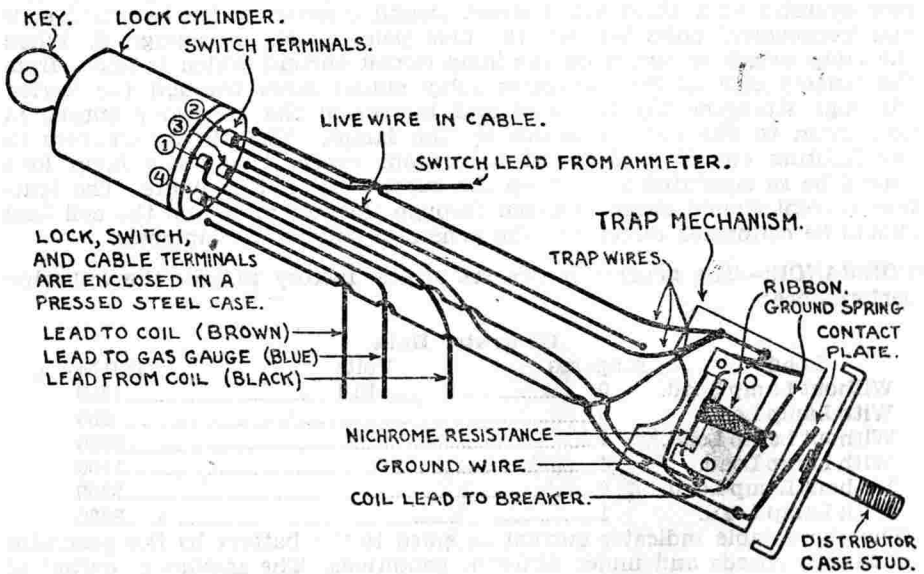
(1) Disconnect the ignition coil and gas gauge and turn the distributor shaft until the breaker contacts open or block contacts open with a piece of cardboard. Then place one test point on primary terminal inside distributor housing and place the other test point on the ammeter terminal from which the lead is taken to the switch. With the switch locked or in the 'Off' position the lamp should not burn. With the switch in the 'On' position the lamp should burn.

(2) Then place one test point on primary terminal as in test (1) and ground the other test point by touching it to the distributor housing or engine block. With the switch in the 'On' position the lamp should not burn. With the switch in the 'Off' position the lamp should burn. If the lamp burns in the 'On' position disconnect the condenser and repeat the test. If the lamp still burns the trap mechanism is defective. If the lamp does not burn the condenser is shorted or grounded.

(3) Place one test point on ammeter terminal connected to switch and touch the other test point to the brown wire connected to the ignition coil. With the switch in the 'Off' position the lamp should not burn. With the switch in the 'On' position the lamp should burn.

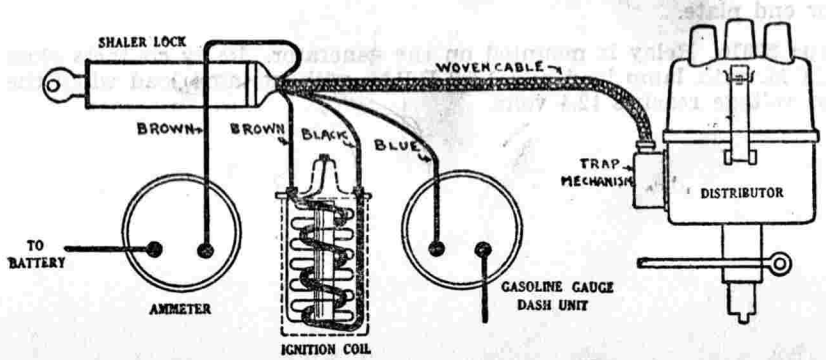
If these tests indicate the switch is operating satisfactorily, check the ignition coil, breaker contacts, spark plugs and high tension wiring for defects causing the ignition trouble.

JW-1090.



SHALER LOCK SWITCH

WIRING DIAGRAM.



AC ELECTRIC GASOLINE GAUGE

DESCRIPTION:—The AC Gasoline Gauge is of the electric type and consists of two units, a dash unit or recording gauge and a tank unit or measuring device mounted on the gasoline tank. The dash unit is mounted on the instrument panel. It consists of two coils in which an armature is free to move. The pointer of the gauge is fixed to this movable armature. The dash gauge is connected to the ignition circuit and to the tank unit through insulated wires. The tank unit consists of a fixed resistance and a movable contact arm which is connected to a double float which floats on top of the gasoline in the tank.

OPERATION:—Terminal (1) of the Dash Unit is connected to coil side of the ignition switch so that current is supplied to the gauge whenever the ignition is turned on. The current flows through coil 'A' of the gauge to terminal (2). The second coil is connected to this terminal and the other end of the coil is grounded. The tank unit is likewise connected to terminal (2). The tank unit consists of a resistance coil 'C' of Chromel wire. A movable arm 'D' which is grounded moves across the resistance coil. This arm is connected to the float which rises and falls with the gasoline in the tank so that the resistance is cut in or out of the gauge circuit as the gasoline level in the tank changes. When the gasoline tank is empty the float will be at its lowest position and the contact arm will be in position 'E'. This means that the resistance is entirely out of the circuit and that coil 'B' of the dash unit is shorted. Current will flow through coil 'A' to ground attracting the armature and swinging the pointer to the 'Empty' position. As the level of gasoline in the tank rises the contact arm will swing to the right, cutting more of the resistance in series with coil 'A' and causing more of the current to flow through coil 'B' until when the float reaches the highest position with the gasoline tank full the resistance will be entirely in series with coil 'A' and entirely out of the circuit of coil 'B'. Coil 'B' will thus attract the armature and cause the pointer to swing to the 'Full' position of the dial.

The gauge is of the 'Balanced Coil' type and variations in battery voltage will have no effect on the accuracy of the gauge readings. The current consumption is 1/6-1/16 ampere while the gauge is operating and need not be considered.

MOUNTING:—Both the dash unit and tank unit are grounded. If they are taken off the car care must be used in mounting to see that a good ground is provided. It is not practical to attempt repairs to either the dash unit or tank unit and if units are defective they should be replaced. If the gauge does not register correctly, check trouble from following table:

Pointer does not move when ignition switch is turned on.

The line from the ignition switch to the dash unit is open. Check connections and supply a new lead from the coil side of the ignition switch to the 'IGN' terminal of the gauge.

Gauge indicates 'Full' at all times.

The line from the dash unit to the tank unit is open. Test connections and if necessary replace line with insulated wire.

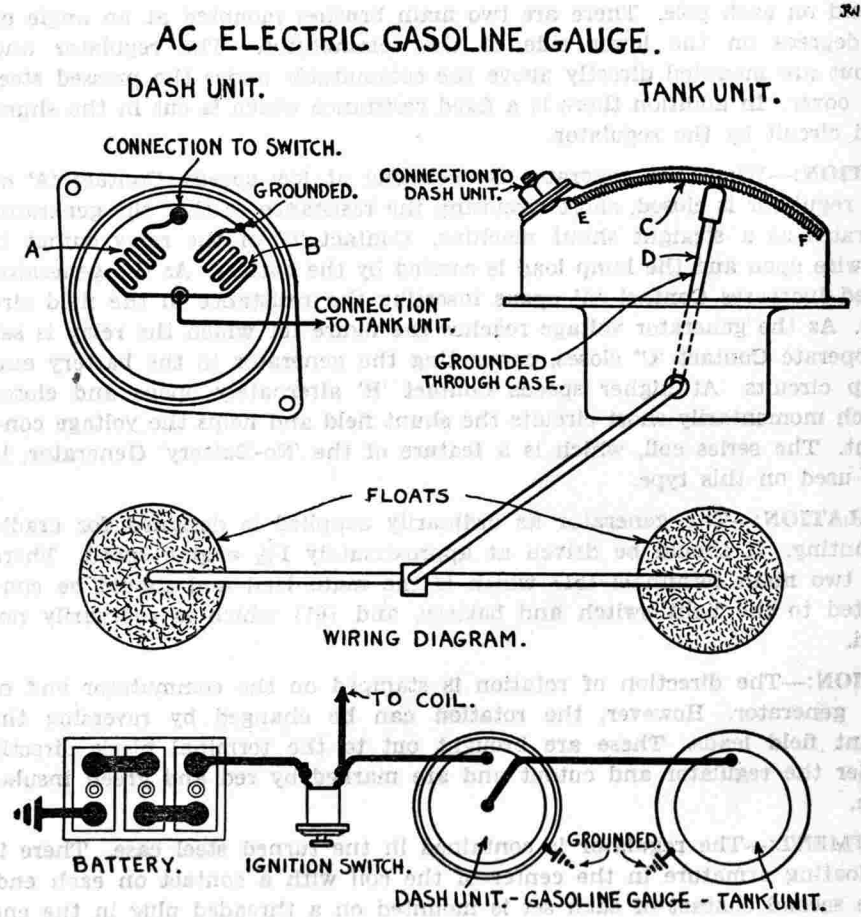
Wires reversed on dash unit. Reverse connections and see if gauge registers correctly.

Gauge indicates 'Empty at all times.

Dash unit not grounded. See that unit is properly grounded to car frame. If gauge still does not register correctly, the dash unit must be replaced.

Tank unit not grounded. See that tank unit is grounded to gasoline tank or car frame. If gauge does not register the tank unit must be replaced.

JW-1152.



ROBERT BOSCH GENERATOR

BATTERY TYPE

DESCRIPTION:—This type Bosch Generator has been developed for use with a battery. It is of the voltage regulation type which charges the battery at a constant voltage so that the current delivered to the battery depends directly on the battery itself. The charging current will be relatively high with a discharged battery and tapers off as the battery becomes charged. This keeps the battery in a fully charged condition and at the same time eliminates all danger of overcharging.

The generator is of the four pole shunt wound type with a field coil wound on each pole. There are two main brushes mounted at an angle of 90 degrees on the lower side of the commutator. The regulator and cutout are mounted directly above the commutator under the pressed steel end cover. In addition there is a fixed resistance which is cut in the shunt field circuit by the regulator.

OPERATION:—When the generator is operating at low speeds, Contact 'A' of the regulator is closed, short circuiting the resistance so that the generator operates as a straight shunt machine. Contact 'C' of the relay cutout is likewise open and the lamp load is carried by the battery. As the generator speed increases Contact 'A' opens inserting the resistance in the field circuit. As the generator voltage reaches the figure for which the relay is set to operate Contact 'C' closes, connecting the generator to the battery and lamp circuits. At higher speeds Contact 'B' alternately opens and closes which momentarily short circuits the shunt field and helps the voltage constant. The series coil, which is a feature of the 'No-Battery' Generator, is not used on this type.

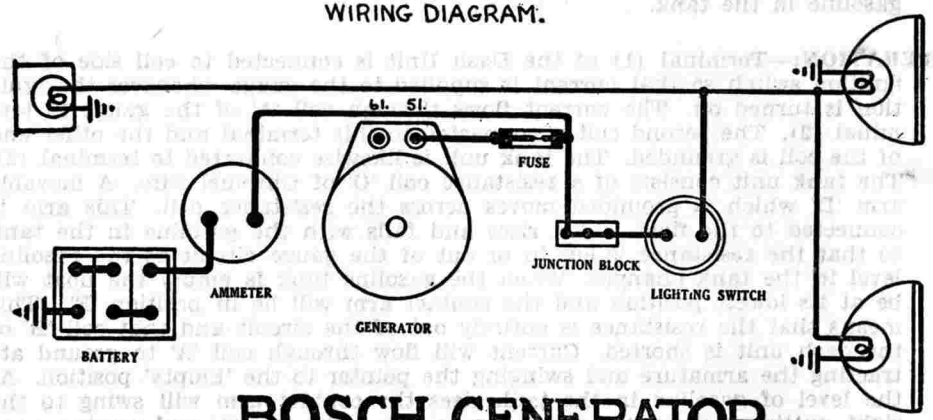
INSTALLATION:—The generator as ordinarily supplied is designed for cradle mounting. It should be driven at approximately 1½ engine speed. There are two main terminals (51) which is the main lead and should be connected to the light switch and battery, and (61) which is ordinarily not used.

ROTATION:—The direction of rotation is stamped on the commutator end of the generator. However, the rotation can be changed by reversing the shunt field leads. These are brought out to the terminal block directly under the regulator and cutout and are marked by red and green insulation.

ADJUSTMENT:—The regulator is contained in the turned steel case. There is a floating armature in the center of the coil with a contact on each end. The second contact of each set is mounted on a threaded plug in the end cap of the regulator case. One contact plug is fitted with a very fine thread for fine adjustments. The regulator is adjusted by varying the contact gap. The Robert Bosch Company have developed special tools for use in setting the regulator and it will not be possible to secure as satisfactory an adjustment without their use.

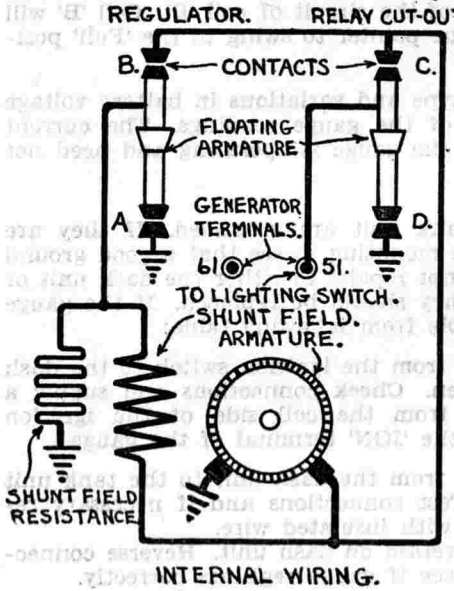
OILING:—The armature shaft is carried on ball bearings which are packed with a special heat resisting grease. These bearings will not require any attention in service but whenever the generator is disassembled for inspection or servicing, the bearings should be repacked with the special grease secured from the Robert Bosch Company.

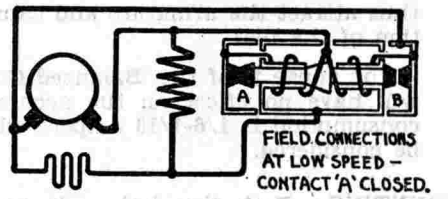
WIRING DIAGRAM.

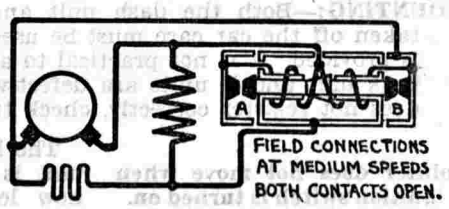


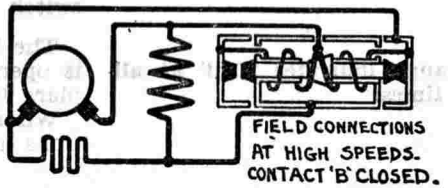
BOSCH GENERATOR

BATTERY TYPE.









ROBERT BOSCH GENERATOR

"NO BATTERY" TYPE

DESCRIPTION:—The Bosch No-Battery Generator has been developed for use on trucks and tractors and is designed to operate lights at six volts without a battery. The generator is of the voltage control type and the regulator holds the voltage at a constant figure throughout all speeds so that lamp filaments will not burn out at high speeds. It will not operate with a battery in circuit and no battery should be used. The internal winding of the Bosch Generator for use with a battery differs (see next page) and this generator should be used with battery circuits. The No-Battery Generator is a four pole shunt wound machine with a shunt coil wound on each pole. In addition there is a series winding on one pole. The regulator operates in conjunction with a fixed resistance which is cut in the shunt field circuit.

OPERATION:—When the generator is operated at low speeds with all lamps turned off, Contact 'A' of the regulator is closed and Contact 'B' is open. This means that the shunt field of the generator is grounded at both ends since the other side of the shunt field is connected to the lamp side of the lighting switch. Likewise Contact 'C' of the relay cutout is open. The generator is thus entirely inoperative. When the lighting switch is turned on at low speeds the shunt winding is connected directly across the main brushes with the resistance coil shorted out. The current generated flows through the series coil and helps to strengthen the field. As the speed of the generator increases Contact 'A' of the regulator opens inserting the resistance in series with the shunt field. When the voltage of the generator rises to the maximum figure for which the regulator has been set, Contact 'C' closes shorting out the series winding. At higher speeds Contact 'B' of the regulator alternately opens and closes which momentarily short circuits the shunt field and holds the voltage constant.

INSTALLATION:—The generator is designed for either cradle or flange mounting. Each type is provided with a shaft extension for accessory drive. It must be driven at crankshaft speed or higher (a ratio of 1½ times engine speed will probably be most satisfactory). The generator is supplied in various types for different outputs although the type K 50/6 500 rated at 50 watts and designed to operate two headlights (21 cp), two side lights, and dash and tail light will be found in most installations. There are two terminals on the generator (51), which is the main terminal and should be connected to the lighting switch through a ten ampere fuse, and (69), which is the field lead and must be connected to the lamp side of the lighting switch.

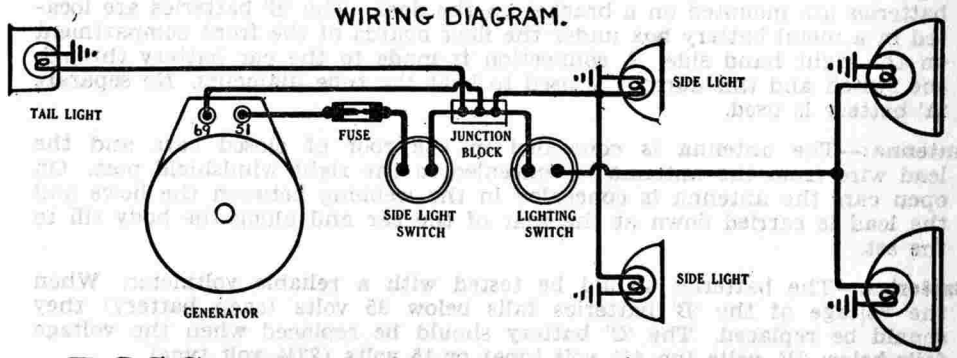
ROTATION:—The generator is designed to be operated in the direction marked on the commutator end of the generator. However, the direction of rotation can be changed by reversing the connections on the shunt field and series field coils. The field leads are distinctly colored and marked and are brought out to the junction block on the commutator end of the generator directly under the regulator and relay cutout.

PERFORMANCE:—The output of the generator under load is shown on the following table:

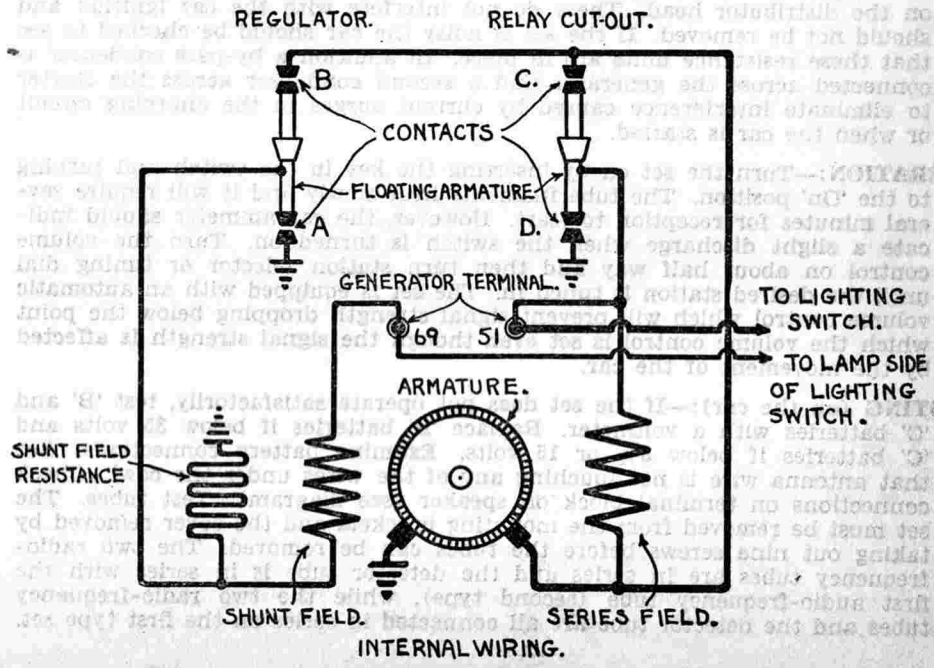
Amperes	Volts	R.P.M.
2.2	1.0	200
3.75	3.5	300
5.0	5.6	400
5.4	6.4	600
5.5	6.7	800
5.5	6.75	1000
5.5	6.75	2000

ADJUSTMENT:—The regulator is contained in a turned steel case with a floating armature in the center of the coil having a contact on each end. The stationary contact of each set is contained in the end cap of the regulator case and is mounted on a threaded plug. One contact plug has a very fine thread which makes it possible to secure fine adjustments. The Robert Bosch Company have developed special service tools to set the regulator and it will not be possible to secure as satisfactory a setting without their use.

OILING:—The armature shaft is carried on ball bearings which are packed with special heat resisting grease. These bearings will not require any attention in service but if the generator is disassembled for service work they should be repacked with this special grease secured from the Robert Bosch Company.



BOSCH NO-BATTERY GENERATOR.



DELCO-REMY RADIO

DESCRIPTION:—The Delco-Remy Radio designed for automobile installation is a five tube set using two stages of radio frequency (224 or 424 tubes), a detector (224 or 412-A tube) and two stages of audio-frequency amplification (227 or 427 tube in the first stage and a 112A or 412-A tube in the second or power stage). All tubes are of the new 'screen grid' type. Two types of receiver are in use. These differ primarily in wiring (see diagram) and 'C' batteries used. The first type is equipped with three 4½ volt batteries and a three terminal volume control switch while the second set uses a single 22½ volt 'C' battery and a two terminal volume control. Sets may be identified by this means. The receiving set is contained in a single case mounted under the cowl. It is tuned by a dial on the instrument panel connected to the set through a flexible cable control. The volume control is mounted at the left of the tuning dial and a switch is mounted at the right of the dial. The speaker is also concealed under the cowl. The 'C' batteries are mounted on a bracket on the dash. The 'B' batteries are located in a metal battery box under the floor boards of the front compartment on the right hand side. A connection is made to the car battery through the switch and this current is used to heat the tube filaments. No separate 'A' battery is used.

Antenna:—The antenna is concealed in the roof of closed cars and the lead wire from the antenna is concealed in the right windshield post. On open cars the antenna is concealed in the webbing between the bows and the lead is carried down at the rear of the car and along the body sill to the set.

Batteries:—The batteries should be tested with a reliable voltmeter. When the voltage of the 'B' batteries falls below 35 volts (each battery) they should be replaced. The 'C' battery should be replaced when the voltage falls below 3½ volts (on 4½ volt type) or 15 volts (22½ volt type).

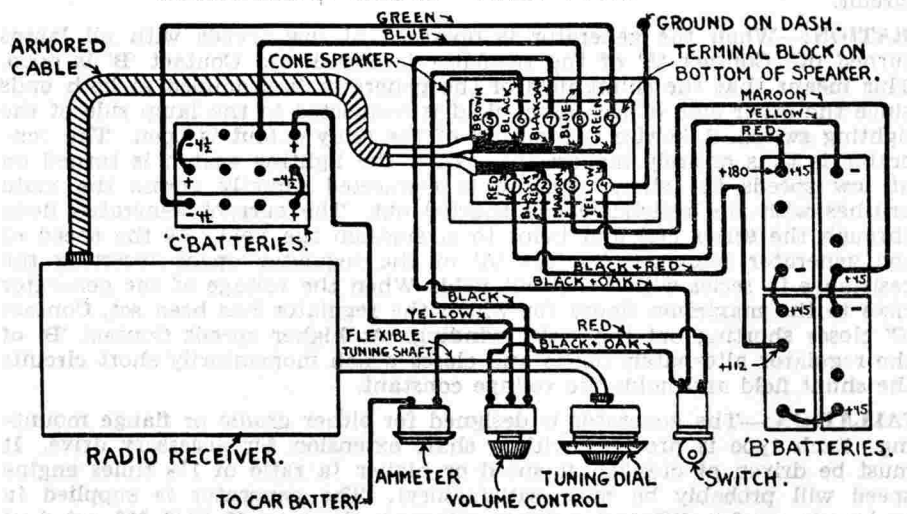
Resistances:—A special spark disturbance suppressor resistance is installed in each high tension lead at the spark plugs and in the coil high tension lead on the distributor head. These do not interfere with the car ignition and should not be removed. If the set is noisy the car should be checked to see that these resistance units are in place. In addition a by-pass condenser is connected across the generator and a second condenser across the starter to eliminate interference caused by current surges in the charging circuit or when the car is started.

OPERATION:—Turn the set on by inserting the key in the switch and turning to the 'On' position. The tube filaments heat slowly and it will require several minutes for reception to start. However, the car ammeter should indicate a slight discharge when the switch is turned on. Turn the volume control on about half way and then turn station selector or tuning dial until the desired station is tuned in. The set is equipped with an automatic volume control which will prevent signal strength dropping below the point which the volume control is set even though the signal strength is affected by the movement of the car.

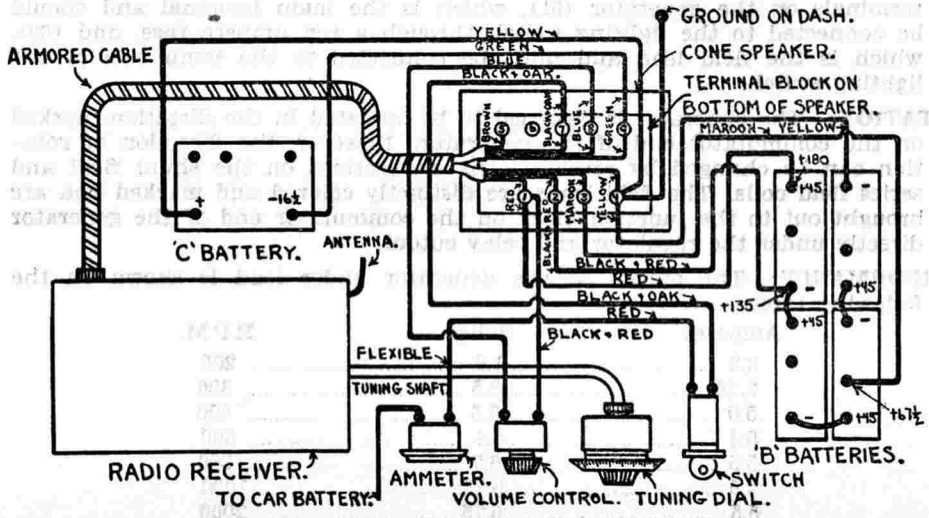
TESTING (on the car):—If the set does not operate satisfactorily, test 'B' and 'C' batteries with a voltmeter. Replace 'B' batteries if below 35 volts and 'C' batteries if below 3½ or 15 volts. Examine battery connections. See that antenna wire is not touching any of the wires under the cowl. Check connections on terminal block on speaker (see diagram). Test tubes. The set must be removed from the mounting brackets and the cover removed by taking out nine screws before the tubes can be removed. The two radio-frequency tubes are in series and the detector tube is in series with the first audio-frequency tube (second type), while the two radio-frequency tubes and the detector tube are all connected in series on the first type set. Failure of any one tube will prevent the other tubes in the circuit from heating. If possible, tubes should be tested in a regular tube tester. If tube tester is not available, substitute a new tube for the one that is suspected. If these tests do not locate trouble, the set should be removed from the car for further tests on the bench.

To Remove Set:—Disconnect 'B' battery connections to prevent short-circuits and shocks (the line voltage is 140 volts). Disconnect antenna lead wire. Disconnect tuning control by loosening knurled nut at end of control cable at set. Disconnect leads on terminal block on speaker. Remove the bottom plates on the receiver support brackets and lift receiver from place.

DELCO-REMY RADIO - FIRST TYPE.



SECOND TYPE



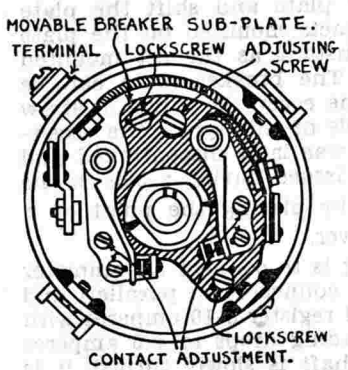
DISTRIBUTORS
SYNCHRONIZATION OF CONTACTS

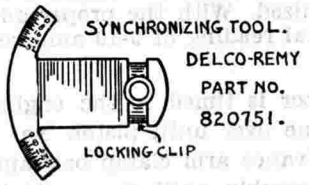
DELCO-REMY
TYPES 650, 656, 659

DESCRIPTION:—These types are designed for use on six cylinder engines. They are fitted with two sets of contacts operating on a three sided cam. Contacts open alternately (one set opening an instant before the other set closes) at intervals of 60 degrees which corresponds with the 120 degree firing interval of the engines on which they are designed to be used. The two sets of contacts control the same coil and are connected in parallel in the primary circuit of the ignition system. All these types are identical in principle and are synchronized in the same manner although they differ in constructional details.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch at all times. Set contact gap by loosening lock screw on stationary contact mounting plate (located directly behind breaker arm) and turning eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. This must be done before attempting to synchronize contacts. If the synchronizing operation affects the setting sufficiently to throw the gap outside the limit of .018-.024 inch it must be reset at .022 inch and the synchronization repeated.

SYNCHRONIZATION OF CONTACTS:—A special tool has been developed to synchronize contacts. This is Delco-Remy Part No. 820751. To synchronize contacts, remove distributor head and rotor. Set contact gaps. Then place the synchronizing tool on shaft so that the 'A' side of the spring rests in the slot on the shaft (clockwise distributors) or the 'B' side of the spring rests in the slot (counter-clockwise distributors). Rotate the distributor shaft until the graduations on the leading tool scale approach the slot in the distributor housing. Connect a six volt test lamp in series with the coil primary and turn on the ignition. Continue to turn the shaft until the lamp goes out, indicating that the contacts have opened. Note the scale graduation which is in line with the edge of the slot. Then continue to turn shaft until the same figure on the other scale is opposite the same edge of the slot. This will indicate that the distributor has been turned through 60 degrees and the lamp should go out at this point, indicating that the second set of contacts has opened. If it does not, loosen the lock screws on the movable breaker plate on which this set of contacts is mounted and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check the contact opening. It must be within limits of .018-.024 inch. If outside these limits, reset at .022 inch and repeat synchronization. If the slot cannot be used as a reference mark, a mark may be made on the edge of the distributor housing opposite the '0' mark on the scale when the first set of contacts open. The tool is graduated in engine degrees. Contacts must be synchronized within two degrees or one graduation on the tool.



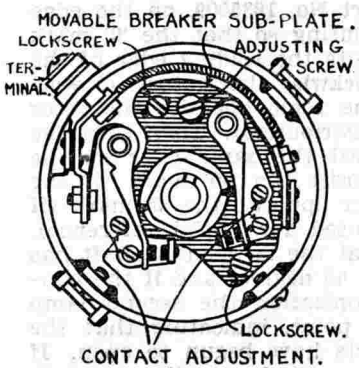


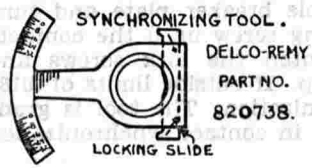
DELCO-REMY
TYPES 651, 657, 658

DESCRIPTION:—These types are designed for use on eight cylinder engines. They are fitted with two sets of contacts on a four sided cam. The contacts open alternately at intervals of 45 degrees corresponding to the 90 degree firing interval of the engines on which they are used. Both sets of contacts control the same coil and they are connected in parallel in the primary circuit of the ignition system. Both contacts must be open to secure a spark at the spark plug. This is accomplished by designing one set of contacts to close immediately after the other set opens. All these types operate on the same principle although they differ in constructional details.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch. Set contact gap by loosening lock screw on stationary contact mounting plate (directly behind breaker arm) and turning eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. Tighten the lock screw. This must be checked before the contacts are synchronized.

SYNCHRONIZATION OF CONTACTS:—A special Delco-Remy synchronizing tool, Part No. 820738, has been developed for this purpose. To synchronize contacts, remove distributor head and rotor and check contact gap. Then place synchronizing tool on shaft and lock it in place by pushing the slide through from the side. The slide is marked with an arrow at each end. One arrow will be visible when the tool is locked on the shaft and the slide should be locked so that the visible arrow points in the direction of distributor rotation. Turn the distributor shaft until the contact set mounted on the base plate begins to open when a six volt test lamp, which should be connected in series in the primary circuit, will go out. Carefully note the reading on the leading scale at a point directly opposite the edge of the terminal plate slot in the distributor housing. Then continue to turn the distributor shaft until the same point on the other scale is opposite the same slot edge on the housing. This will indicate that the shaft has been turned through 45 degrees and the lamp will go out, indicating that the second set of contacts are opening if they are properly synchronized. If the lamp does not go out at this point, loosen the two lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check the contact gap. If outside limits of .018-.024 inch, reset at .022 inch and repeat synchronization.





DISTRIBUTORS

SYNCHRONIZATION OF CONTACTS

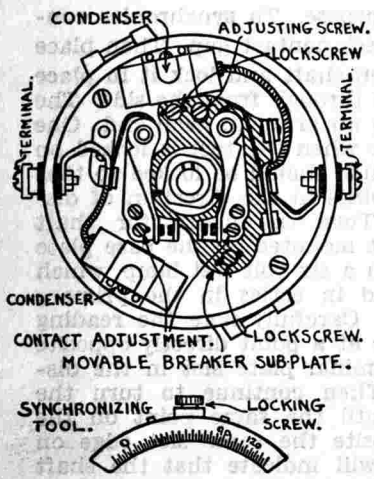
DELCO-REMY

TYPE 668

DESCRIPTION:—This type distributor has two sets of contacts operating on a four sided cam. Contacts open alternately at intervals of 45 degrees which corresponds with the 90 degree firing interval of the eight cylinder engines on which the distributor is designed to be used. Each set of contacts is fitted with a condenser and there is no electrical connection between the two sets. The distributor is used with two ignition coils and each set of contacts controls one coil, firing four cylinders of the engine. The synchronization of the contacts is very important in that the timing of four cylinders will be thrown out if the contacts are allowed to get out of synchronization and the engine performance will be unsatisfactory.

CONTACT ADJUSTMENT:—Breaker contacts should be set at .022 inch and must be held within limits of .018-.024 inch. Set contact gap by loosening lock screw on stationary contact mounting plate and turning eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. Tighten the lock screw.

SYNCHRONIZATION OF CONTACTS:—One set of contacts is mounted on the base plate while the second set of contacts is mounted on a movable breaker plate. To synchronize contacts, first connect a six volt test lamp in series with each primary circuit. Then remove distributor head and turn distributor shaft until the first set of contacts begin to open when the lamp will go out. Clip the special synchronizing tool, Delco-Remy Part No. 1835009, on the edge of the distributor housing so that the '0' mark on the scale is opposite the leading edge of the rotor contact (for clockwise distributors) or with the '90' mark on the scale opposite the rotor (counter-clockwise distributors). Then turn the distributor shaft until the same edge of the rotor contact is opposite the '90' mark (if the '0' mark was used) or opposite the '0' mark (if the '90' mark was used for initial reference). This will indicate that the distributor shaft has been turned through 45 degrees and if the contacts are in synchronization the second lamp will go out at this point, indicating that the second set of contacts have begun to open. If the lamp does not go out, loosen the two lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check the contact gap. If outside limits of .018-.024 inch, reset at .022 inch and repeat synchronization. The tool is graduated in engine degrees. The allowable variation in contact synchronization is 2 degrees or one graduation on the tool.



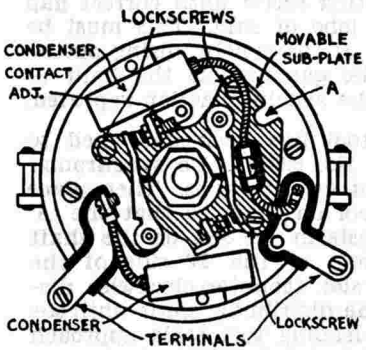
DELCO-REMY PART NO. 1835009.

AUTO-LITE

TYPE IGE

CONTACT ADJUSTMENT:—Breaker contact gap when new or with new breaker arms should be .020-.024 inch. After 1000 miles of operation the gap should be set at .018-.020 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is secured with breaker arm rubbing block on lobe of cam. Use a feeler gauge and set contacts carefully. It is very important that both contacts have the same gap.

SYNCHRONIZATION OF CONTACTS:—Some means of determining when the contacts open must be used as it is absolutely impossible to determine the break visually with sufficient accuracy. The most satisfactory method is to connect six volt test lamps across each set of contacts so that the lamp will light at the instant the contacts open. To synchronize contacts with test lamps in circuit, turn on ignition and turn engine over slowly until contacts open. If both lamps light at exactly the same instant, the contacts are correctly synchronized. If they do not, loosen the three 'lock screws' on the movable breaker plate and shift the plate until the set of contacts mounted on the plate open at the same instant as the set mounted on the base plate. The breaker plate can be shifted by turning the eccentric adjusting screw 'A' on the first models of this type. The eccentric adjusting screw was later discontinued and distributors are now issued having a slot in the plate at this point. The plate can be shifted by placing the point of a screwdriver in the slot and turning the screwdriver.



AUTO-LITE - TYPE IGE AND TYPE IGK EXCEPT FOR 8 LOBE CAM.

Another method of testing the contact opening is to connect an ammeter in the ignition primary circuit (the two coils are connected in parallel) and noting the ammeter reading. The ammeter should register 8-10 amperes with both sets of contacts closed. If the ammeter reading drops to 4-5 amperes and then to 0 in two steps as the distributor shaft is slowly turned, it is an indication that the contacts must be synchronized. With the proper adjustment, the ammeter should drop from the initial reading of 8-10 amperes to 0 at once.

TIMING DISTRIBUTOR TO ENGINE:—The distributor is timed to the engine in the usual manner by first cranking the engine over until piston No. 1 reaches firing position and then loosening the advance arm clamp bolt and rotating the distributor housing and breaker assembly until the contacts open. Full directions are given on each individual car model page.

DISTRIBUTORS

SYNCHRONIZATION OF CONTACTS

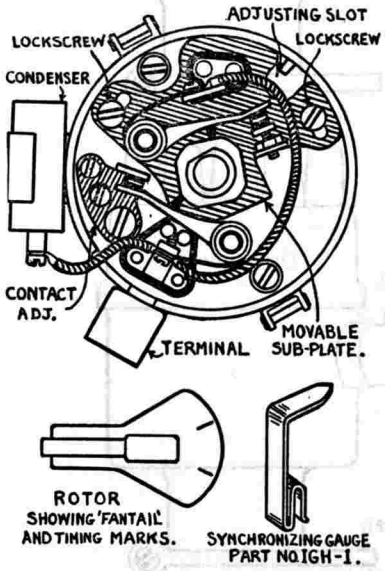
AUTO-LITE

TYPE IGH

DESCRIPTION:—The two sets of contacts on the Type IGH distributors are connected in parallel to the breaker terminal on the distributor housing. The condenser is mounted on the side of the case. Only one ignition coil is used and the primary circuit is broken by the two sets of contacts alternately. For this reason it will be necessary to use a special synchronizing tool to establish the correct relation between the contacts.

CONTACT ADJUSTMENT:—Breaker contacts separate .020-.024 inch. This gap should be maintained at all times. To set contact gap (fixed contacts mounted on base plate), loosen the two lock screws on the stationary contact mounting plate and turn eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. Then tighten the lock screws. The other set of contacts (mounted on movable breaker plate) are adjusted by loosening lock nut on stationary contact mounting stud and turning up stud. Tighten the lock nut after making the adjustment. It is important that the contact gap of each set of contacts should be the same. Use a feeler gauge to accurately determine the gap.

SYNCHRONIZATION OF CONTACTS:—Connect a six volt test lamp between the primary terminal inside the breaker housing and ground (snap the other test lamp lead on the distributor case). Block open the second set of contacts (mounted on movable breaker plate) with a piece of cardboard. Then turn on ignition and slowly crank engine over until the first set of contacts open as indicated by the lighting of the lamp. If this position is accurately determined the backlash in the gears will be sufficient to open and close the contats and the lamp should go out as the distributor shaft is rocked. Place rotor button on distributor shaft. It will be noted that rotor is built with a 'fantail' marked with two lines. These lines are exactly 45 degrees apart (distributor degrees) and represent the firing interval of the distributor. Clamp the special synchronizing gauge (Auto-Lite Part No. IGH-1) on the side of the distributor case so that the pointer of the gauge is directly opposite the leading line (determined by direction of rotation of the distributor) on the fantail. Then carefully crank engine over 90 degrees until the second line on the fantail is directly opposite the synchronizing gauge. Remove the insulation from between the breaker contacts and block open the first set in the same manner. If the lamp lights when the second line on the fantail is opposite the gauge the distributor contacts are correctly synhronized. If it does not, loosen the two lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts open and the lamp lights. Tighten the lock screws.



TIMING DISTRIBUTOR TO ENGINE:—Distributor is timed to the engine in the usual manner by cranking engine over until piston No. 1 reaches firing position and then loosening the advance arm clamp bolt and rotating the distributor housing and breaker assembly until the contacts open. The correct firing position of the piston and full directions for each installation will be found on the car model pages.

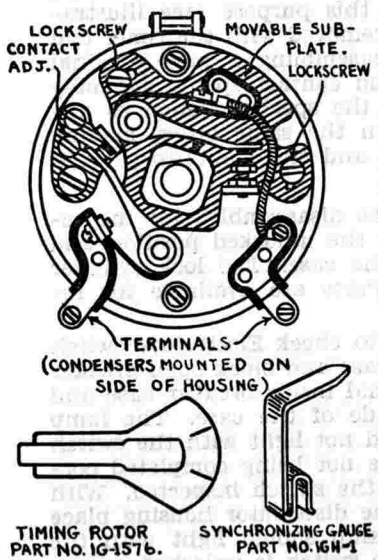
AUTO-LITE

TYPE IGJ

DESCRIPTION:—This type distributor is used in conjunction with two coils, each coil controlled by one set of contacts. There is no electrical connection between the two breakers although they operate on the same cam. It is very important to synchronize these contacts as the ignition of one half the entire number of cylinders will be thrown off if the contacts are allowed to get out of synchronization.

CONTACT ADJUSTMENT:—Breaker contacts separate .020-.024 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is secured with breaker arm rubbing block on lobe of cam. The contact gap should be the same on both sets and a feeler gauge should be used to accurately set contacts.

SYNCHRONIZATION OF CONTACTS:—Connect a six volt test lamp across each set of contacts. It will not be necessary to block open one set of contacts since they are electrically separate. Crank the engine over slowly until the contacts (mounted on stationary base plate) begin to open and the lamp lights with the igniton turned on. Then place the special 'Master Timing Rotor,' Part No. IG-1576, on the shaft and clip the synchronizing gauge, Part No. IGH-1, on the edge of the case opposite the leading mark on the fantail of the rotor. Carefully crank the engine over until the second mark is directly opposite the gauge. If the second lamp does not light at this point, indicating that the second set of contacts are opening, loosen the lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts begin to open. With the correct adjustment the back lash in the gears will be sufficient to open and close the contacts and the lamp should light and go out as the distributor shaft is rocked. The regular production rotor used on these distributors will be equipped with timing marks and it will only be necessary to use the special master timing rotor on the early equipment.



NOTE:—All production rotors furnished as car equipment will be equipped with the fantail and timing marks. However, rotors have been used without these marks. It is possible to secure special rotors to use in timing these distributors from the Auto-Lite Company. These are known as "Special Master Timing Rotors" and carry the regular production rotor part number IG-1576.

ELECTROLOCK

TYPE 9

TYPE 9-A

DESCRIPTION:—The Type 9 Electrolock differs from the Type 5 in that the lock cylinder does not spring out as the switch is unlocked and has simply a one-quarter turn rotary movement. The key hole in the lock is vertical with the switch locked. To turn on ignition, the key must be inserted and turned to the right. The key may then be removed as the switch locks automatically when the ignition is turned off by turning the lock cylinder back to the vertical position. The Type 9-A Electrolock has one terminal on the side of the case. This should be connected to the ignition coil and the other coil terminal should be connected to a 'hot' terminal of the car wiring circuit ordinarily the discharge side of the ammeter. The Electrolock is coincidental in operation, grounding the coil and breaker through the switch mounting on the instrument board and the cable attachment on the distributor when the switch is turned off. No provision is made for the connection of gasoline gauges or other accessories to be controlled by the ignition switch and if devices of this kind are installed they must be provided with a separate switch, or a Type 9-B Electrolock installed.

To Remove Electrolock from Distributor. The Type 9 Electrolock is fitted with a 'serviceable timer end' and the Electrolock and cable assembly can be removed from the distributor housing and replaced. To remove the snap terminal assembly (distributor housing assembly) from the Electrolock, first remove snap terminal assembly and cable from distributor. Then cut the terminal post to remove the grounding cup and insulating washer. This will expose the timer end nut which is staked in place. Unscrew the nut, using the special spanner wrench designed for this purpose (see illustration). The snap terminal assembly can then be removed with the timer end lock ring attached to the terminal stud. In reassembling a new terminal stud and lock ring must be used. The timer end contact spring assembly on the cable can also be disassembled by using the special wrench to unscrew the nut. In reassembling, replace parts in the same order, making certain that the insulating washers are in place and stake nuts to prevent their working loose in service.

SERVICING ELECTROLOCK:—The Electrolock can be disassembled for inspection and service by turning the lock cylinder to the unlocked position and then removing the small screw in the side of the case. The lock cylinder can then be withdrawn, exposing the switch. Parts are available for replacement and repairs can be made.

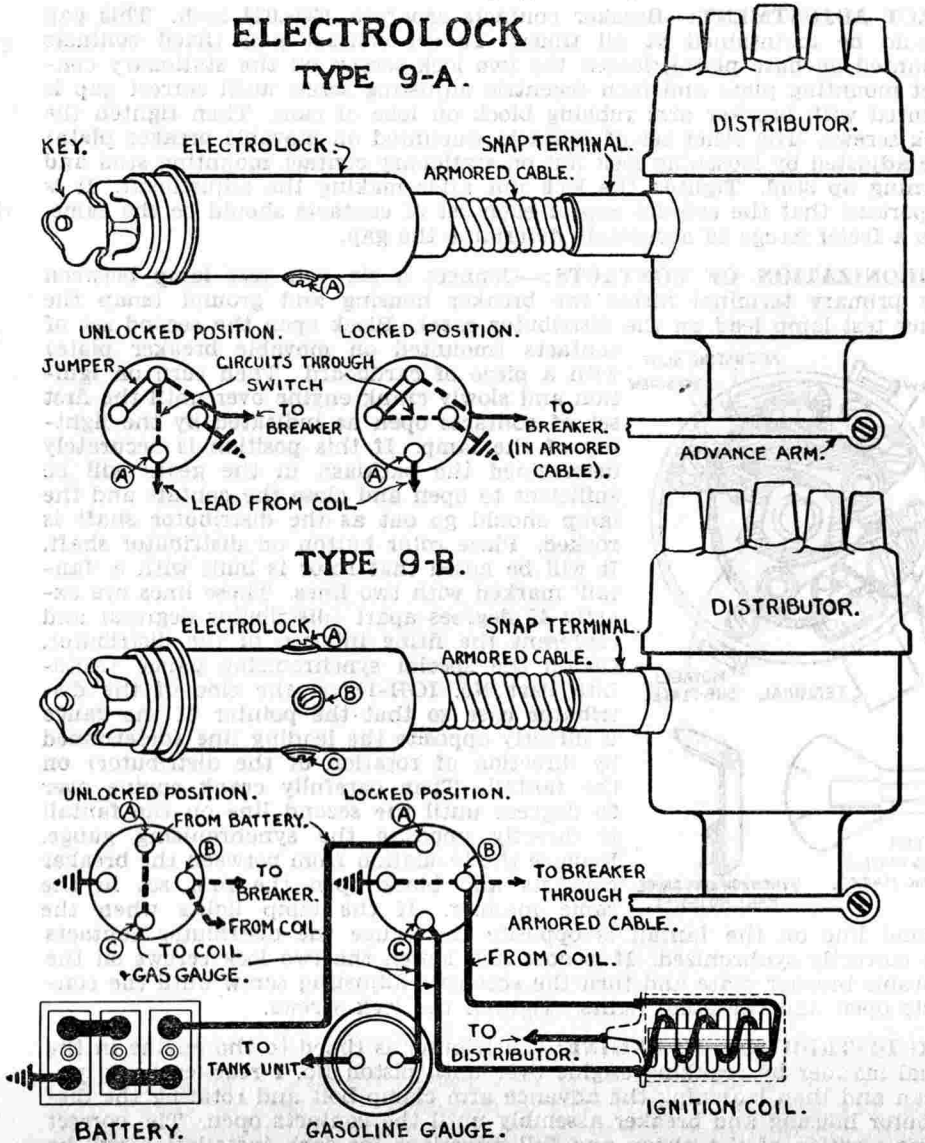
Trouble Shooting. Use a lamp and test points to check Electrolock switch circuits. Disconnect wire at terminal on side of case and block open breaker contacts. Place one test point on primary terminal inside breaker case and the other test point on the terminal on the side of the case. The lamp should light with the switch unlocked and should not light with the switch locked. If test lamp indicates switch circuits are not being completed correctly, the lock cylinder should be removed and the switch inspected. With one test point on the primary terminal inside the distributor housing place the second test point on the lock case. The lamp should light with the switch off or locked and should go out when the switch is unlocked.

If the lamp remains lighted with the switch unlocked, the Electrolock is grounded or the condenser is grounded. Disconnect the condenser and repeat the test. If this indicates that the condenser is at fault it should be replaced. If these tests indicate that the Electrolock is all right and ignition trouble continues, check the ignition coil, breaker contacts, distributor, spark plugs and spark plug cables.

TYPE 9-B

DESCRIPTION:—The Type 9-B Electrolock is similar in design to the Type 9-A except that it is provided with three terminals on the side of the case and should be used when gasoline gauges or other accessories are used which must be controlled by the ignition switch. The ignition lead is connected to one terminal on the case and the two coil leads are connected to the other two terminals. The gasoline gauge and other accessories should be connected to the feed terminal of the coil on the case (and never to the breaker lead from the coil). The breaker lead from the coil is completed through the Electrolock armored cable in the usual manner and the coil and breaker are grounded when the switch is locked.

SERVICING DISTRIBUTOR AND ELECTROLOCK:—The Electrolock is removed and serviced in exactly the same manner as the Type 9-A. In making tests with lamp and test points, disconnect wires at Electrolock terminals and use terminal marked 'Coil.' In rewiring ignition circuit make certain that all leads are insulated down to the screw heads to avoid any possibility of short circuit to the case. Never use grease or oil in the lock cylinder. If the tumblers stick a small amount of graphite may be used on them.



TRANSITONE RADIO

DESCRIPTION:—The Transitone Radio is a six tube set using three stages of radio-frequency (201-A or 301A tubes), a detector (200-A or 300-A tube in the first set and a 112-A tube in the second type) and two stages of audio-frequency amplification. A 201-A or 301-A tube is used for the first stage of audio-frequency and a 112-A tube in the second or power stage. Two types of receivers are in use. The first type has the complete receiver mounted in a single shielded box mounted on the dash of the car. With this type the loud speaker was placed above the windshield of the car (some cars are fitted with two loud speakers, one in the front compartment and one in the rear) and are connected to a toggle switch on the dash. Where only one speaker is used, connections are made to the auxiliary output jack on the instrument panel. This jack permits a portable loud speaker to be plugged in, disconnecting the car speaker, and providing reception at a distance.

The second type set is mounted in two shielded cabinets both mounted on the dash. The cabinet containing the tuning condensers (connected with the tuning dial on the instrument panel through a flexible cable control) contains the three stages of radio-frequency and the detector tube. The second cabinet contains the two stages of audio-frequency amplification. With this installation the loud speaker is mounted on the dash and is plugged in a jack in the side of the second box. A portable speaker can be plugged in after the regular car speaker has been disconnected.

Antenna:—The antenna is built in the roof of colsed cars and the lead wire is run down the windshield post to the set. On open cars the antenna is concealed in the roof and the lead is carried down at the back of the top and through the body of the car.

Batteries:—The filament current for the tubes is taken from the regular car battery and no 'A' battery is installed. The current consumption will be approximately 1½ amperes. Three 45 volt vertical 'B' batteries are installed in a metal battery box under the car floor. Two 4½ volt 'C' batteries are also located in the battery box. Batteries should be tested with a voltmeter while the set is in operation. When the voltage of the 'B' batteries falls below 35 volts (each battery) and the 'C' battery voltage below 4 volts, the batteries should be replaced with standard radio batteries, preferably the same make and type as originally used.

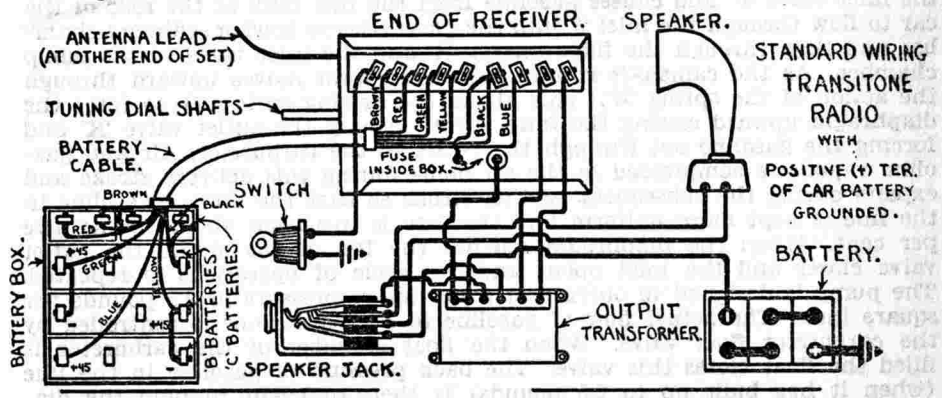
Interference. To eliminate interference caused by th eelectrical system of the car, 'suppressors' or spark disturbance eliminators are connected in the high tension leads at each spark plug and in the coil to distributor lead on the distributor head. These do not interfere with the car ignition and should not be removed. A special by-pass condenser is also connected across the car generator to eliminate interference caused by current surges in the charging circuit.

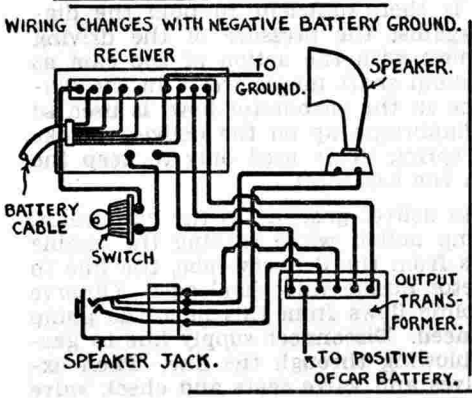
OPERATION:—Turn the set on by inserting the key in the switch on the instrument panel and turning to the right. This switch controls the filament current of the tubes. The tuning dial (second type) or two tuning dials (first type) should then be turned to bring in the desired station. Volume is controlled by the small knob in the center of the tuning dial (second type). Reception on cars is affected by the location of the car in respect to distance and the shielding action of surrounding objects. Reception may not be uniform with the car in motion.

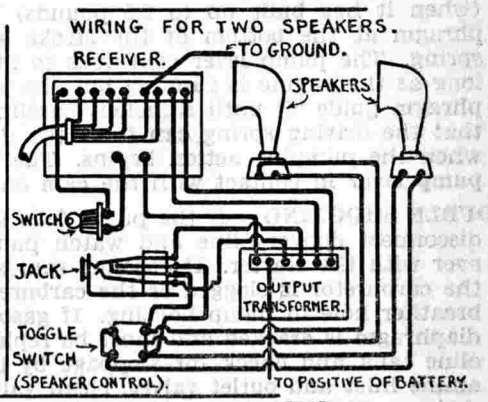
TESTING:—Turn on set. There should be a distinct click from the speaker as the switch is turned off and on. If this click is not heard, examine battery connections and see that 'A' battery is properly connected. The set must be connected exactly as shown on the diagrams. Test 'B' and 'C' batteries. If 'B' batteries test less than 35 volts and 'C' batteries less than 4 volts, they should be replaced. On first type set open cover and examine fuse on side of case. Examine tubes. If any tube does not light, replace with a tube of the same type. Disconnect speaker and plug in a test speaker or set of headphones. If the set operates satisfactorily the speaker must be replaced. The first type set is connected to the speaker through an output transformer mounted on the front dash. The transformer should be tested by a voltmeter in series with a battery. If the voltmeter indicates voltage reading with the test leads clipped first to the speaker terminals on the transformers and then to the two set terminals indicating that the two windings are in good order the transformer is all right.

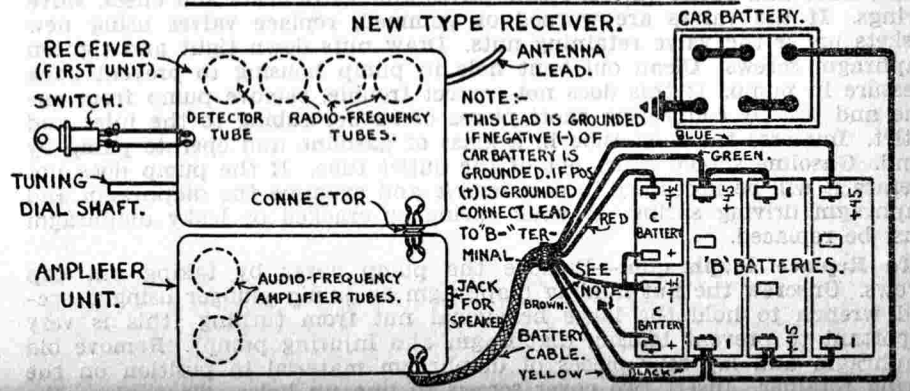
If Reception is Weak. Test batteries with radio turned on. Replace 'B' batteries if voltage reading is less than 40 volts. Replace tubes which do not light up properly. The tubes should be tested on a regular tube tester if possible since the filament test is not conclusive. Examine car battery for poor connections due to corrosion or loose terminals.

If Reception is Noisy. On the first type set turn the two tuning dials until the index numbers are widely different. This will eliminate outside signals. If the noise stops it has been caused by external conditions due to location of car, etc. If noise continues, turn off volume control. If this does not eliminate noise the detector tube should be replaced. Noisy reception while the car is traveling which disappears when the car is stopped may be caused by loose connections or faulty connections in the tube sockets. Remove tubes and see that contact prongs on tubes are clean and making firm contact with the contacts in the socket.









STEWART WARNER FUEL PUMP

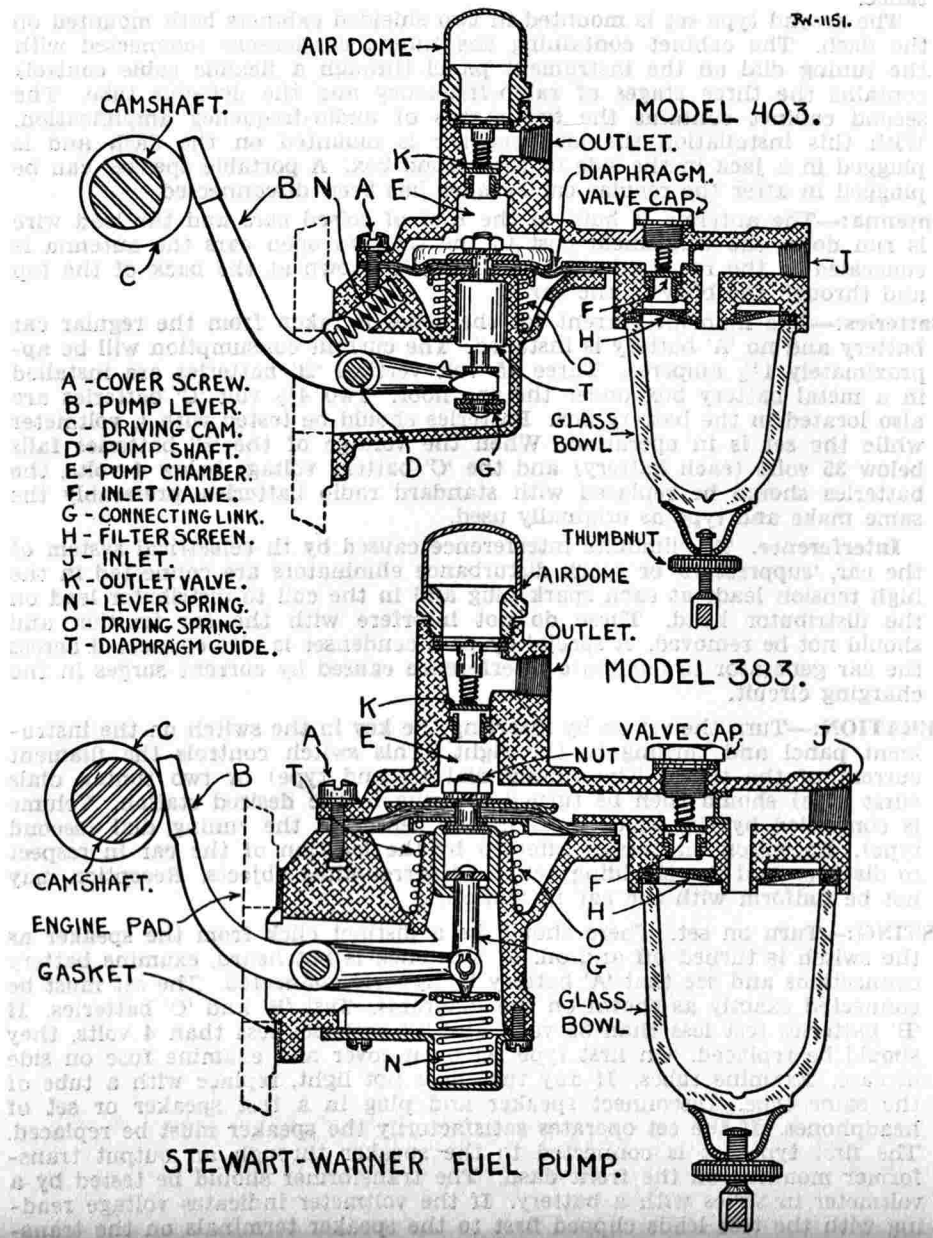
MODELS 383 AND 403

DESCRIPTION:—The Stewart Warner Fuel Pump is a mechanical diaphragm pump driven from the cam shaft of the engine and designed to deliver gasoline from the fuel tank at he rear of the car to the float chamber of the carburetor. A filter and glass sediment bowl are incorporated in the supply line of the pump so that all fuel passes through the glass bowl and then through a fine mesh strainer before it enters the pump chamber. From the pump chamber it is forced to the carburetor bowl, maintaining a constant supply which is designed to be in excess of the actual requirements of the engine. There is an air dome on the pump directly over the outlet valve which relieves the carburetor float valve of excessive pressure on the delivery stroke of the pump by allowing the air in the dome to be compressed.

OPERATION:—On the suction stroke of the pump the special cam on the camshaft forces the lever 'B' down, drawing the pump shaft and diaphragm downward. This creates a vacuum in the pump chamber 'E' which opens the inlet valve 'F' and causes gasoline from the fuel tank at the rear of the car to flow through the inlet 'J' into the glass reserve bowl or sediment chamber and then through the filter screen 'H' and the inlet valve to the pump chamber. As the camshaft rotates the pump lever moves upward through the action of the spring 'N'. This allows the driving spring 'O' to force the diaphragm upward closing the inlet valve, opening the outlet valve 'K' and forcing the gasoline out through the outlet to the carburetor. Air and gasoline vapor are compressed in the air dome during this delivery stroke and expand during the subsequent suction stroke so that the flow of gasoline in the line is kept more uniform and the rate is increased about twenty five per cent. When the diaphragm reaches the top of the stroke the outlet valve closes and the inlet opens and the cycle of operations is repeated. The pump is designed to operate at a maximum pressure of 2.5 pounds per square inch. The actual flow of gasoline to the carburetor is controlled by the carburetor float valve. When the float chamber of the carburetor is filled the float closes this valve. The back pressure of gasoline in the line (when it has built up to 2.5 pounds) is then sufficient to hold the diaphragm at the bottom of the stroke against the pressure of the driving spring. The pump lever continues to move with the action of the cam as long as the engine is running but the pump shaft moves freely in the diaphragm guide 'T' until sufficient gasoline in the carburetor bowl is used so that the driving spring can force the diaphragm up on the delivery stroke when the pumping action begins. The spring 'N' is used only to keep the pump lever in contact with the cam on the camshaft.

TROUBLE SHOOTING:—If the pump fails to deliver gasoline to the carburetor, disconnect delivery line and watch pump action while turning the engine over with the starter. If gasoline spurts from the delivery tube, the line to the carburetor is clogged or the carburetor needle valve is clogged. Observe breather hole in pump housing. If gasoline flows from this hole, the pump diaphragm is cracked and must be replaced. Disconnect supply line to gasoline tank and check for stoppage by blowing through the line. Then examine inlet and outlet valves, clean valves and valve seats and check valve springs. If the valves are warped or gummed, replace valves using new gaskets under the valve retaining nuts. Draw nuts down tight and tighten diaphragm screws. Clean out vent hole in pump housing to prevent back pressure in pump. If this does not correct trouble, remove pump from engine and test by connecting short pieces of rubber tubing to the inlet and outlet. Immerse the inlet tube in a glass of gasoline and operate pump by hand. Gasoline should spurt out of the outlet tube. If the pump does not operate it will be necessary to disassemble and examine the diaphragm and diaphragm driving spring. A weak spring or cracked or leaky diaphragm must be replaced.

To Replace Diaphragm:—Remove the pump cover by taking out cap screws. Unscrew the nut holding diaphragm on pump plunger using a second wrench to hold the large hexagonal nut from turning (this is very important to prevent tearing diaphragm and injuring pump). Remove old diaphragm and lay four pieces of diaphragm material in position on the spring retainer. Insert two cover screws to line up holes. Then place the two washers on the diaphragm, lining up the keyways in the washers and diaphragm with the key on the pump plunger stud. Compress driving spring by forcing these parts down on the stud until they seat properly with the key engaged in the keyway and screw the retaining nut down (holding the large hexagonal nut with a second wrench to prevent turning). Then place the pump cover on the diaphragm and engage the cover screws. Turn these screws down about three threads and then flex diaphragm by pushing the pump lever toward the pump as far as possible. Hold it in this position while the cover screws are tightened. This is very important to allow the proper pump action. In replacing the pump on the engine make certain that he gasket is in place between the pump and the engine pad. The pump will prime itself in approximately 20 strokes or 40 R.P.M. of the engine.



STEWART-WARNER FUEL PUMP.

DISTRIBUTORS

SYNCHRONIZATION OF CONTACTS

CHECKING OF CONTACTS

SINGLE CONTACT BREAKERS:—An accurate determination of the instant the breaker contacts open with relation to the position of the piston and crankshaft cannot be made with sufficient accuracy by observing the contacts and the use of test lamps is strongly recommended. However in simple ignition systems (using a single breaker arm and one set of contacts) it may be sufficient to determine when the spark occurs by watching the ammeter or the spark at the spark plugs. In making this test, the engine should be turned over until piston No. 1 (or the piston to be used for timing—see car data sheet) is approaching top dead center on the compression stroke. The ignition should then be turned on and the engine turned over slowly by tapping the crank with the hand. The ammeter will indicate the current drawn by the ignition coil, ordinarily 2-5 amperes. At the instant the contacts open, the ammeter pointer will swing back to '0'. If the piston is at the firing position when this occurs the ignition setting is satisfactory. If no one is available to turn the engine over while the ammeter is being watched, the spark plug cable can be detached from the spark plug in the cylinder being used for timing and placed so that a spark gap of ⅛ inch is formed between the cable terminal and the engine block. The spark will jump this gap at the instant the contacts open.

DOUBLE CONTACTS—ALTERNATE OPENING:—This method can also be applied to distributors using two breaker arms and two sets of contacts with alternate opening. In all systems of this type, both sets of contacts must be open to secure a spark; this is accomplished by arranging one set of contacts to open an instant before the previous set have closed. It is important to keep the contact gap for both sets of contacts exactly the same and the contacts should be examined and adjusted whenever the ignition is checked. When test lamps are used, one test lamp lead should be clipped to the breaker terminal on the distributor housing and the second test lamp lead grounded to the distributor housing. The ignition should be turned on. The lamp will light at the instant the contacts open. If it is not possible to turn on the car ignition, one test lamp should be clipped to the distributor terminal and the other lead connected to a 'hot' terminal such as the relay terminal on the generator, or the horn feed. The lamp will remain lighted as long as the contacts are closed and will go out at the instant the contacts open.

DOUBLE CONTACTS—SIMULTANEOUS OPENING:—On distributors using two sets of breaker contacts connected in parallel in the coil primary circuit, a test lamp will only indicate the opening of the second or last set of contacts if the contacts are not synchronized so as to open simultaneously. Each set of contacts must be tested separately. In making these tests with the test lamp connected as directed above, block open one set of contacts with an insulator (piece of cardboard, etc.), and check the opening of the second set of contacts. Make a mark on the flywheel to indicate the point of contact opening, or see that the contacts open when the ignition mark is opposite the indicator. Then turn the engine through one complete revolution, remove the insulation from the first set of contacts and block open the other set. Check the opening of the first set of contacts and see that the same point on the flywheel is at the indicator. See data on distributors for specific instructions on adjusting the breaker to secure this simultaneous opening.

DUAL IGNITION OR DOUBLE COIL SYSTEMS:—Systems of this type either have two spark plugs in each cylinder fired by separate coils or each coil fires half of the total number of spark plugs. There are two sets of breaker contacts, each controlling one coil and electrically separate from the other. The contact opening of each set of contacts must be checked individually by connecting a test lamp in each primary circuit. The test is similar in all respects to the test for 'Double Contacts—Alternate Opening'.

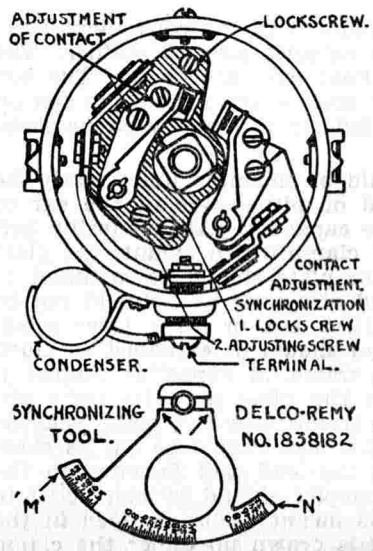
DELCO-REMY

TYPE 660 AND 661

DESCRIPTION:—This type distributor is designed for use on eight cylinder engines. It is fitted with two sets of contacts operating on a four sided cam. The contacts open alternately at intervals of 45 degrees corresponding to the 90 degree firing interval of the engines on which it is used. Both sets of contacts are connected in parallel in the primary circuit of the ignition coil. One condenser mounted on the side of the distributor shaft housing is used for both contacts. The breaker arms are designed so that one set of contacts closes immediately after the other set opens which provides a longer period of time for building up the coil primary current. Both sets of contacts must open to secure a spark at the plugs.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch. Set contact gap by loosening the lock screw on the stationary contact mounting plate (directly behind the breaker arm) and turning the eccentric adjusting screw. The breaker gap must be measured with the breaker on the lobe of the cam. Tighten the lock screw. Contacts can be resurfaced when necessary with a fine flat contact file or on a medium hard oilstone. The contact gap must be set before the contacts are synchronized and should be checked after the synchronization has been completed. If synchronizing has affected the gap sufficiently to throw it outside the limits of .018-.024 inch, reset the gap at .022 inch and repeat the synchronization.

SYNCHRONIZATION OF CONTACTS:—A special Delco-Remy synchronizing tool, Part No. 1838182, has been developed for use in synchronizing contacts on Type 660 distributors. Place the synchronizing tool in position on the upper end of the distributor shaft with the spring on the left or 'M' side of the tool in the slot in the cam (if the distributor rotates clockwise) or with the right or 'N' side of the spring in the cam slot (if the distributor rotates counter-clockwise) and connect a test lamp or ammeter in the primary circuit and turn on the ignition so that an accurate check of the contact opening can be made. Then turn the distributor shaft in the direction of rotation until the first set of contacts (mounted directly on the breaker plate—the so-called stationary contacts) begin to open. Note the reading on the center scale which is directly in line with the leading edge of the slot in the distributor housing. Continue to turn the distributor until the same reading on the 'N' side of the scale (for clockwise distributors) or the 'M' side of the scale (for counter-clockwise distributors) is in line with the same edge of the distributor housing slot. Then loosen the two lock screws on the movable sub-plate (on which the second set of contacts are mounted) and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check synchronization by turning the distributor shaft through a complete revolution and again noting scale readings as contacts open. The variation must not be greater than 2 tool graduations which corresponds to 2 degrees of crankshaft rotation. The contact gap must be checked after synchronizing contacts. If outside limits of .018-.024 inch, reset at .022 inch and repeat synchronization.



BOSCH RADIO

MODEL 80

DESCRIPTION:—The Bosch Model 80 Radio for automotive use is a five tube set with three stages of radio-frequency amplification, a detector and one stage of audio-frequency amplification. The three radio-frequency tubes and the detector tube are of the 'Screen Grid' type (Type 224 tubes). The audio-frequency stage is equipped with a power tube (Type 112-A). The entire set is mounted on the dash with the speaker mounted on the front of the case. A control unit is clamped to the instrument board and operates the set through a universal shaft. The 'B' batteries are contained in a battery box which can be mounted in any convenient location, usually under the floor boards of the front compartment. The set is equipped with a counterpoise or Capacitor plate which is mounted to the car frame under the body. This Capacitor plate is connected to the set and for this reason no antenna in the roof of the car is necessary. The car battery is used for filament current and no additional 'A' or 'C' batteries are required.

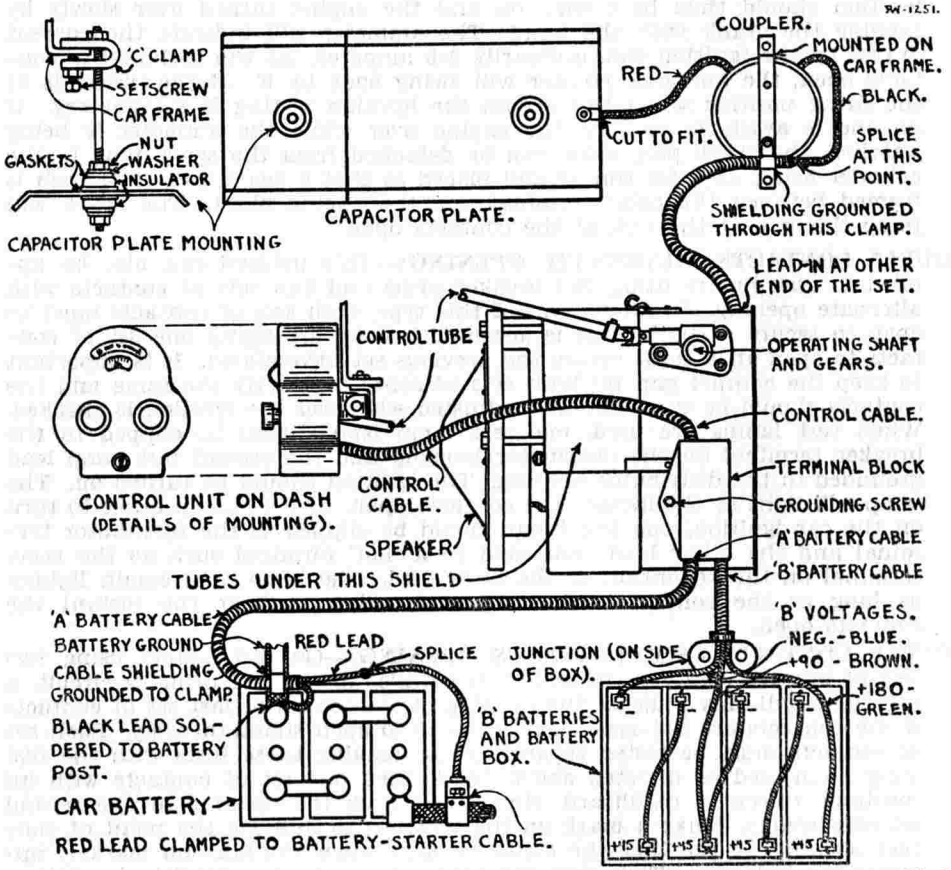
MOUNTING:—Radio Set. The Radio Set has two adjustable brackets by which it is mounted to the dash. The brackets can be assembled and used as a template in drilling the mounting holes. These should be placed so that the set will not interfere with the instruments which project back of the instrument board and the holes will not strike the vacuum tank or other accessories mounted on the engine side of the dash. If the dash is entirely free from obstructions, the brackets may be discarded and the set mounted directly on the dash. In any case the set should be mounted on the mounting frame so that it is protected from vibration by the rubber cushions. The tubes can then be placed in the tube sockets and the tube shield replaced. The speaker is mounted on the front of the set.

Control Unit. The Control Unit can be mounted on the instrument board in any position so long as the universal shaft which operates the set does not bind. Use the universal bracket as a template in drilling the mounting holes and then bolt this bracket in place. The small angle bracket can then be installed. The universal bracket is slotted so that the angle bracket can be leveled. The control unit can then be bolted in place. The drive shaft is made in two pieces and the long solid piece must be cut to fit individual installations. Slip the shaft in place in the sleeve on the set, turn the station selector to '100' and turn the drive shaft to the left as far as possible. Then tighten the set screw in the universal joint on the control unit.

'B' Battery Box. The battery box can be mounted in any convenient location provided it is not placed too near the exhaust pipe or muffler. The battery box cover should be bolted to the floor with four bolts. The box can then be mounted by using the four long bolts which mount the box on the cover. A special armored cable is provided for 'B' battery connections. Connect wires as shown on the diagram.

Capacitor Plate. The capacitor plate should be mounted underneath the chassis in any location. It can be mounted on either side of the car or across the chassis if desired. The nut on the capacitor plate mounting bolt must be tight before the set screw in the 'C' clamp which mounts the plate on the car frame is tightened. The capacitor plate should be mounted as low as possible without interfering with road clearance and should not be placed too near the engine, muffler, 'B' battery box or other large metal objects. The capacitor plate is adjustable and should be extended as much as possible when it is mounted on the car frame. A capacitor coupler is provided which must be connected between the plate and the radio set. The coupler should be mounted on the car frame near the plate and the red lead must be connected to the plate. This lead should be cut as short as possible, the spade terminal soldered to the lead and fastened to the capacitor plate. The black lead from the coupler should be connected to the shielded lead-in to the set. This lead is meant to be clamped in the coupler mounting band and if the shielding is drawn up under the clamp it will be properly grounded. It must, however, be kept back from the coupler splice to prevent the capacitor plate being grounded.

'A' Battery Cable. A shielded cable is used to tap the automobile battery for the 'A' current supply for the set. A special ground clamp is provided to replace the ordinary ground lead on the battery. This is provided with a clamp to hold the 'A' cable and the shielding on the cable must be drawn under the clamp so that it will be properly grounded. The black or ground lead in the cable should be soldered to the battery terminal which is grounded and the red lead should be spliced to the battery cable which leads to the starting motor. A special clamp is provided with a pointed set screw. This clamp should be slipped over the cable about one inch from the battery terminal and the set screw tightened until it punctures the insulation and makes contact with the conductor.



Interference Suppressors. Ignition interference suppressors are provided to be connected in the ignition high tension leads. One suppressor should be mounted on the distributor head at the center terminal and a suppressor should be mounted on each spark plug. These suppressors are high resistance resistors and will not interfere with the operation of the ignition system. A condenser is also provided which should be connected between the generator terminal and ground. This will prevent interference due to surges in the charging circuit. In addition, if interference is experienced with the set operating, the armored cable from the set to the control unit may be grounded at the control head end and any loops in the wiring should be straightened out. If desired the ignition coil can be relocated further away from the set.

The three cables, 'A' supply, 'B' battery cable, and control unit cable terminate in a special connector plug on the side of the set. The screw

which holds the terminal plug in position also grounds the three cables and for this reason the screw must always be in place. The speaker can be removed from its mounting on the set and mounted on the roof of the car, which will improve the tone. A special mounting bracket and extension cord is provided for this purpose.

ADJUSTMENT AND TESTING ON THE CAR:—When the radio set is first installed, tune in a station between '30' and '50 on the dial. Reduce the volume until the station can be heard only faintly. Insert the special Bosch service wrench, Part No. 387, in the opening at left of the set near the capacitor cable connector and adjust for maximum volume by turning the wrench back and forth until the best position is found. This setting should be checked if the capacitor plate mounting or location is changed.

Low 'B' Battery Voltage, or No Voltage. No battery voltage indicates an open circuit either at the 'B' battery terminals or in the cable. This can be tested by a 'continuity' test, using a 'C' battery in series with a voltmeter and two test points which are placed on the ends of the battery lead. If the lead is not open, the voltmeter will indicate the total voltage of the 'C' battery. The voltage between the brown and blue battery leads should be 90 volts and between the green and blue leads 180 volts. Test with a voltmeter. If the voltage is below 70 and 140 volts, the 'B' batteries should be tested individually and any battery with a voltage lower than 35 volts should be replaced.

Low 'A' Battery Voltage. Ordinarily whenever the voltage of the car is high enough to operate the car satisfactorily it will be sufficient for operation of the radio set. It is possible, however, that the 'A' battery connections may be faulty or the leads open-circuited and these should be examined.

Capacitor Plate Disconnected or Grounded. Examine the capacitor plate lead and terminal on the plate. Make sure that the grounded shielding on the lead does not touch the plate.

Defective Tubes. The tubes should be tested with a tube tester. If the tube tester is not available, replace the suspected tube with a new tube and see if the operation of the set is satisfactory.

Defective Speaker. Check the speaker by connecting it to another set or touch the speaker terminals to the terminals of a 'C' battery momentarily. A click indicates that the speaker is not open-circuited. The speaker has a balanced armature mounted between laminated pole pieces. The armature must be correctly centered so that it does not touch the pole pieces. The position of the armature is adjusted by using thickness gauges .009 inch thick to center the armature while the mounting screws are tightened.

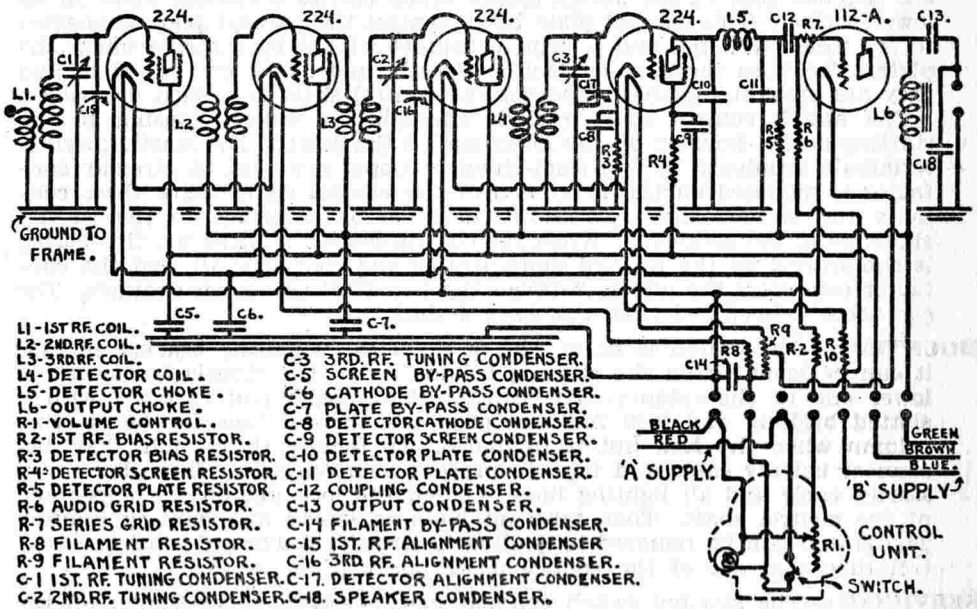
Ignition Interference. This will be particularly noticeable when the engine is idling. Examine the interference suppressors and see that they are mounted on each spark plug and on the center terminal of the distributor head.

Defective Set Chassis. The chassis of the radio set can only be satisfactorily tested by a systematic 'General Test'. A Set Analyzer should be used for this purpose. The analyzer is designed to completely test the set at the tube sockets and is much more thorough and accurate than any other testing methods. However if an analyzer is not available the set can be tested with a voltmeter having scales reading 0-8 volts and 0-200 volts. The voltmeter should be connected to leads ending in test prods which can be inserted in the tube sockets after the tube has been removed. Complete directions for a General Test follow.

TESTING:—The voltmeter should be used to test the tube voltages of the radio-frequency tubes. Filament voltage tests are made from filament to filament terminals, using the low scale on the voltmeter. No reading indicates an open tube, open filament resistor, or an open circuit in the filament wiring. Plate voltages are measured between the plate and cathode terminals, using the high scale of the voltmeter. No reading indicates an open primary on one of the radio-frequency coils, defective wiring or an open connection in the cathode wiring. Screen voltages are measured between the screen and the cathode terminals with the high voltage scale of the voltmeter. No reading indicates an open circuit in the screen or cathode wiring. Grid voltages are measured between the grid terminal (on top of the tube on the Type 224 screen-grid tubes) and the cathode with the low voltage scale of the voltmeter. No reading indicates an open volume control or open radio-frequency bias-register or an open circuit in the cathode wiring.

In testing the detector, the plate voltage registered on the voltmeter will not be the true voltage but will indicate that the circuit is not open. No reading may indicate an open circuit in the cathode wiring. In testing the screen circuit the voltmeter readings may vary due to the voltage drop across the detector screen resistor. No reading may indicate an open circuit in the cathode wiring. In testing the grid circuit, no reading an open secondary winding in the detector coil, defective wiring or an open circuit in the cathode wiring. An open circuit in the cathode wiring may be caused by the detector bias resistor. The detector filament is in series with the third radio-frequency tube. In testing the filament no reading may indicate an open radio-frequency tube, poor socket contact or open filament resistor or wiring.

In testing the audio-frequency tube, no reading in the filament test indicates an open filament resistor, or defective wiring. In the plate circuit test, no reading indicates an open output choke. In the grid test, the high resistance of the series grid resistor will prevent more than a slight movement of the voltmeter pointer.



Tube Socket Voltages for Testing

Stage	Tube Type	Filament	Plate	Screen	Grid
1st Radio-frequency	224	2.0	170	75	3.5
2nd "	224	2.0	170	75	3.5
3rd "	224	2.0	170	75	3.5
Detector	224	2.0	50	15	1.0
Audio-frequency	112-A	4.8	165	..	0.1

In making all tests great care must be used in selecting the correct scale of the voltmeter since the voltage across some terminals is as high as 170-180 volts. This will damage the voltmeter if the low voltage scale is used.

FINGER TIP CONTROL

PINES TYPE

DESCRIPTION:—The Pines Type 'Finger Tip Control' consists of a starting switch, lighting switch, and horn button combined in a single unit which is designed to be mounted at the lower end of the steering column and controlled by a button on the steering wheel. The starting switch is operated by lifting the button slightly, the horn circuit is closed by depressing the button, and the various lighting circuits are completed by rotating the button. There is no electrical connection between the starting switch unit and the lighting and horn control unit, which permits an ammeter to be placed in circuit to show the discharge current. The two terminals on the side of the unit are the starting switch terminals and one terminal should be connected to the car battery. The lead for the generating and lighting circuits should be taken from this terminal. The other starting switch terminal should be connected directly to the starting motor. The six lighting switch terminals are grouped on the front of the switch. These terminals should be connected as follows (left to right facing the bottom of the switch):

1. Headlight (High Beam—lower filament).
2. Lead—Connect to ammeter through fuse or circuit breaker.
3. Tail—Tail light. On some cars, the dash light is taken off also.
4. Park—Parking bulbs, fender lights or side lights.
5. Horn—This is the horn feed lead. The other horn terminal is grounded.
6. Headlight (Low or depressed beam—upper filament).

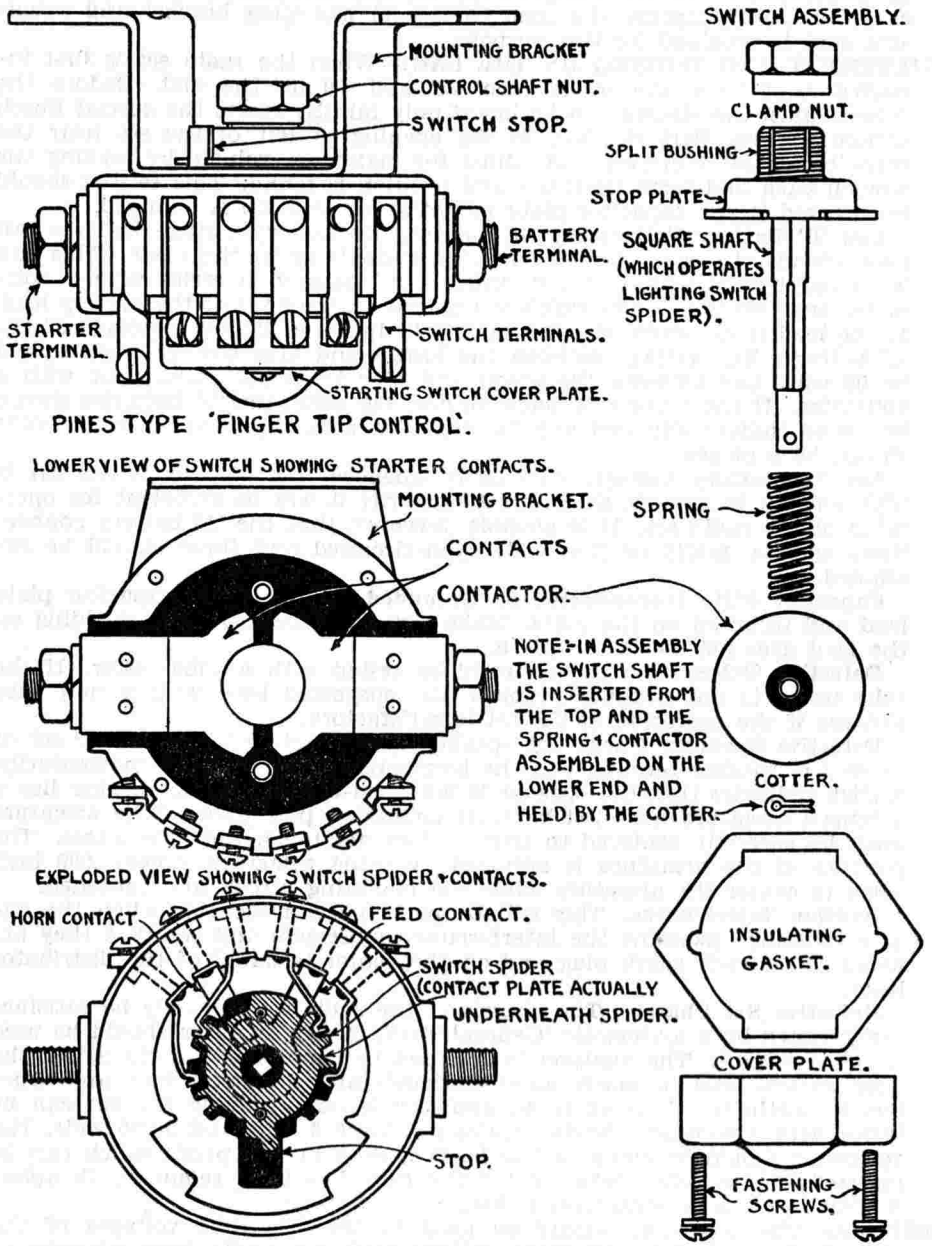
The lighting switch terminals terminate in switch fingers within the switch housing (see exploded view of switch). These switch fingers rest on the notched edge of the switch spider which carries a contact plate on its lower surface. This contact plate bears against the circular plate connected to the 'Lead' terminal and is kept in contact with it by a spring under the plate. The horn terminal contact is directly under this contact plate and they are brought together whenever the control shaft is pushed downward.

The switch control shaft extends through the switch housing to the starting switch housing on the lower end of the switch. The starting switch terminals terminate in two semi-circular copper contacts. A circular contactor is mounted on the lower end of the control shaft below these contacts and is normally separated from them by a spring on the control shaft above the contactor. When the control button is lifted up, this spring is compressed by the upward movement of the control shaft and the contactor completes the circuit between the two starting switch contacts. The contactor is insulated from the control shaft.

MOUNTING:—The switch is fitted with a universal mounting bracket so that it can be mounted on the steering column or on the chassis frame at the lower end of the column. The control shaft upper end is fitted with a slotted bushing and lock nut and grips the control tube in the steering column when the lock nut is tightened. To remove the switch, first disconnect battery cable and tape to prevent short-circuits. Then disconnect starter cable and all lighting lines. Loosen the lock nut on the upper end of the control shaft. Then take out bolts or screws in mounting bracket. The switch can be removed by pulling it straight downward until the control tube slips out of the control shaft bushing.

SERVICING:—The starting switch contacts can be examined by taking off the lower cover plate. To remove cover plate, take out the two screws and lift off the plate and insulating gasket. The contactor on the control shaft can be removed by taking out the cotter pin in the lower end of the shaft. The spring, which will come off with the contactor, must be replaced when the switch is reassembled. If the control shaft is removed, it must be replaced so that the slot in the stop plate is against the stop when the lug on the switch spider is against the stop on the switch body. To secure this result, insert the control shaft and turn the switch spider as far as possible in one direction. Then remove shaft and assemble so that the stop on the top of the switch body prevents the shaft from turning any further in that direction.

The cover plate over the lighting switch spider is riveted in place and it is not practical to attempt any repairs to the lighting switch unit. If tests through the lighting switch with a voltmeter or lamp and test points indicate that the lighting switch is defective, it should be replaced with a new unit.



STEWART WARNER FUEL PUMP

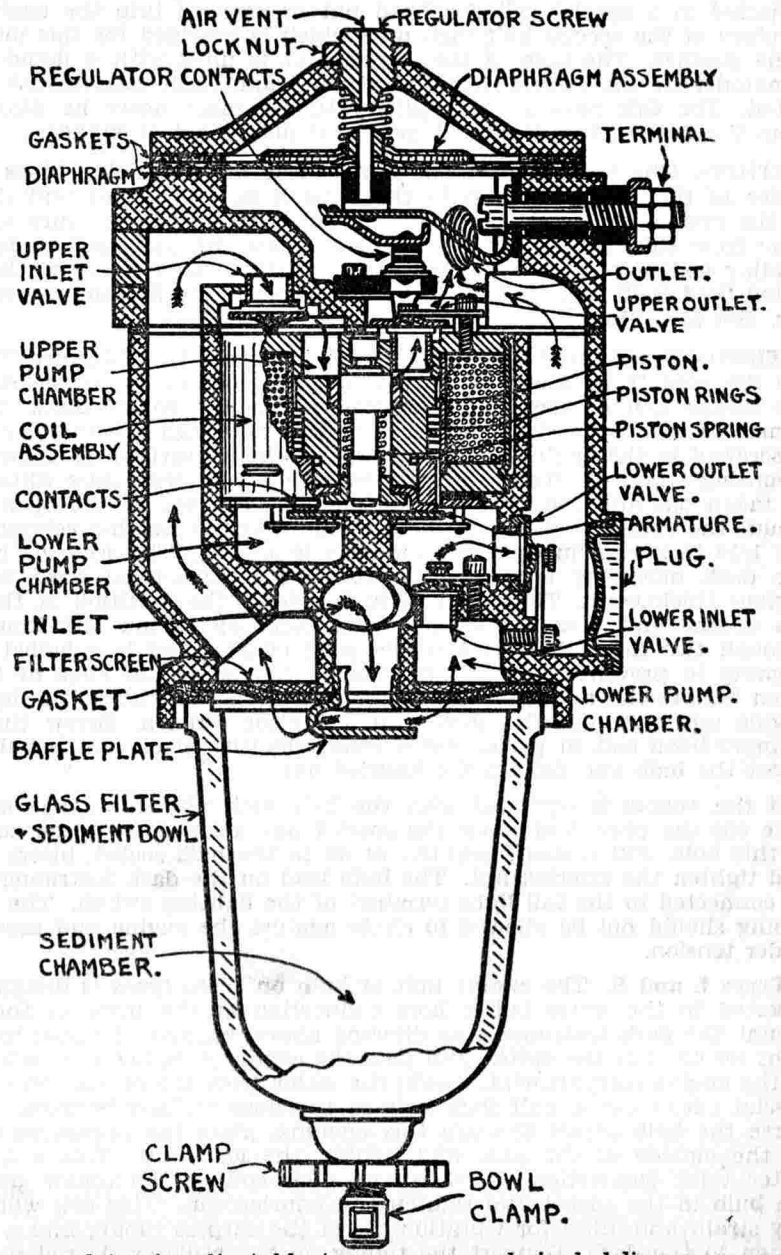
TYPES 409A, B

DESCRIPTION:—The Stewart Warner Fuel Pump is a double acting, piston type, electrical pump designed to replace the original equipment on automobiles in service or for installation in motor boats. The Type 409-A pump is designed to operate on six volts and draws .75 amperes at six volts delivering in excess of 20 gallons of gasoline per hour through 5/16 inch tubing with a twelve inch lift and ten feet of tubing on the intake side and a twelve inch lift and two feet of tubing on the outlet or carburetor side. The Type 409-B unit is designed for 12 volt installations. It draws .5 amperes at 12 volts. Two pumps can be mounted in parallel if a greater pumping capacity is desired or in series if a total lift of more than 2 feet is needed. The pump can be mounted at any desired location on the chassis frame although the height of the inlet on the pump should not be more than 18 inches above the bottom of the tank. Tubing of 5/16 inch diameter (outside) should be used in connecting the pump.

The pump is constructed with a pumping chamber above and below the iron piston which is mounted within the coil. Each chamber is fitted with an intake and outlet valve, drawing gasoline from the filter bowl chamber at the bottom of the pump during one stroke of the piston, and discharging the fuel under pressure into a common delivery chamber from which the outlet opens on the other stroke of the piston. The piston stroke is approximately 5/64 inch and the piston operates, with wide open throttle, at a rate of 1200 cycles per minute. The piston operates on a center guide stud and is sealed by six bakelite piston rings. The coil consists of a single winding which is connected directly to the terminal on the side of the housing through the regulator contacts. The other coil lead is connected through a terminal on the lower end of the coil to a brass armature plate and then through three armature springs to the armature which is directly under the piston. The piston makes contact with the armature at the lower end of the stroke, closing the coil circuit by grounding the armature to the pump frame. The entire lower area of the piston is thus one contact with the armature forming the other contact. The area of these contacts is so great and the fact that they are immersed in gasoline prevents any arc and does not allow the temperature of the contacts to rise. For this reason the manufacturers state that there is no possibility of fire or explosion and the pump is approved by the Board of Fire Underwriters.

The regulator unit is built into the cap on the top of the pump. It consists of a set of contacts in series with the coil which are normally closed when the pump is operating. The upper contact is mounted on a stud which is carried on the lower side of the diaphragm which forms the upper part of the outlet or pressure chamber. The chamber above the diaphragm is open to the air through the vented regulator screw in the center of the cap. Whenever the gasoline pressure in the outlet chamber increases, due to the stopping or idling of the engine and the consequent lessened consumption of gasoline, the diaphragm is forced upward against the pressure of the regulator tension spring (directly above the diaphragm in the regulator chamber) and the regulator contacts open. These contacts open only when the pressure chamber is filled with gasoline and there is thus no arc. The opening of the regulator contacts opens the coil circuit and the pump remains inoperative until the pressure in the outlet chamber decreases, when the pump again begins to operate.

OPERATION:—When the ignition switch is closed, current flows through the regulator contacts (which are normally closed) and the coil to the armature, which is the lower contact. The pump piston at the lower end of the stroke makes contact with the armature, grounding the current to the pump housing. The energizing of the coil draws the piston upward forcing the gasoline in the upper pump chamber out through the outlet valve and is broken. The spring within the piston then pulls the piston down on the down stroke drawing gasoline into the upper pump chamber through the into the outlet chamber from which it flows to the carburetor. At the same time a suction is created in the lower pump chamber under the piston and gasoline is drawn from the fuel tank at the rear of the car through the inlet into the filter bowl and through the screen and the lower inlet valve into the lower pump chamber. As the piston moves upward, the contacts open (as the piston moves away from the armature) and the coil circuit upper inlet valve and forcing the gasoline in the lower pump chamber out through the lower outlet valve into the outlet or pressure chamber. As the piston reaches the bottom of the stroke the contacts again close.



The regulator is adjustable to secure any desired delivery pressure. The regulator spring (which bears against the upper surface of the diaphragm) is carried on the lower end of the regulator screw in the center of the cap and the spring tension can be varied by turning this screw in or out.

MOTOMETER TEMPERATURE GAUGES

TYPES US, UL, NS, N, L, AND FS (FORD SPECIAL)

DESCRIPTION:—These Motometer Temperature Gauges are of the Vapor Tension type. They consist of a dash unit calibrated to read in degrees of engine temperature, an operating bulb or engine unit, and a capillary tube connecting the dash unit with the engine unit. The Types US, UL, and NS are designed for steering column or dash mounting with the engine unit mounted in a special cylinder head nut or screwed into the engine block in place of the special half inch plug which is provided for this purpose on some engines. The bulb of the engine unit is filled with a liquid and the remainder of the system (capillary tubing and dash instrument) is evacuated. For this reason the capillary tubing must never be disconnected from the bulb or the dash unit and must not be cut or kinked.

OPERATION:—The bulb is exposed to the heat of the engine block (or the water in the cooling system in the Type N and L gauge) and the liquid in the system is raised to the same temperature. The pressure which results from this increase in temperature causes the dash unit to indicate a reading which is calibrated in degrees. All these models are of the illuminated 'Red Ball' type and must be connected to the lighting system of the car. See Mounting.

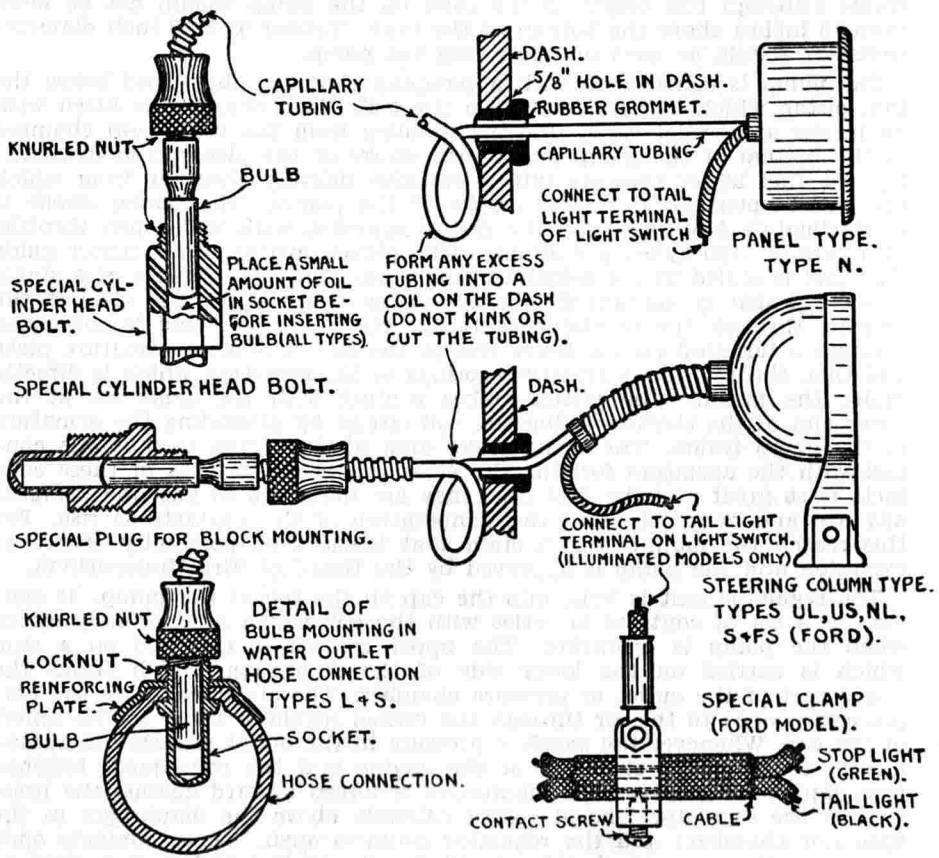
MOUNTING:—Types US, UL NS. These gauges are of the 'Distance Type' and are designed to be mounted on the steering column or on the dash with the engine unit or operating bulb mounted on the engine block. They are furnished with a special cylinder head bolt and with a special plug which is screwed in the engine block on engines where provision is made for this mounting (these engines are equipped with a half inch plug which should de taken out and the special mounting plug screwed in the opening). To mount the gauge, first mount the dash unit on the steering column or drill a 2 1/16 inch hole in the dash for dash mounting. The securing clamp on the dash mounting type is adjustable for mounting on dash boards of various thicknesses. Then drill ⅝ inch hole in the partition at the left of the engine and pass the engine bulb, capillary tubing and knurled nut through this hole. A special rubber plug or grommet is supplied for this opening to prevent the capillary tubing chafing on the edge of the hole. Then remove the nut from the second cylinder head stud at the left of the engine and take out the stud with a Stillson wrench. Screw the special cylinder head bolt in place. Put a small quantity of oil in the bulb socket, insert the bulb and tighten the knurled nut.

If the engine is equipped with the half inch plug for gauge mounting, take out the plug, and screw the special half inch motor block connection in this hole. Put a small quantity of oil in the bulb socket, insert the bulb and tighten the knurled nut. The bulb lead on the dash instrument should be connected to the tail light terminal of the lighting switch. The capillary tubing should not be allowed to chafe against the engine and must not be under tension.

Types L and S. The engine unit or bulb on these types is designed to be inserted in the water outlet hose connection at the front of the engine. Mount the dash instrument as directed above, connect the lead to the tail light terminal of the switch and pass the capillary tubing and bulb through to the engine compartment. Drain the water from the engine, and with the special cutter cut a half inch hole in the hose midway between the ends. Force the bulb socket through this opening, place the reinforcement plate on the outside of the hose and tighten the lock nut. This will make a water tight connection. Form a one inch coil in the tubing and insert the bulb in the socket and tighten the knurled nut. This coil will take up any strain and allow for vibration. Form the surplus tubing into a coil and fasten to the dash. Support the tubing on the radiator tie rod so there is no strain on the tubing at any point. Under no circumstances should any attempt be made to remove surplus tubing by cutting the tube or disconnecting it from the dash gauge or operating bulb as this will destroy the instrument.

If it is necessary to replace the lamp in these instruments, remove the two screws holding the bottom case at the rear of the gauge and insert a 6-8 volt, 2 cp. single contact bulb. If this provides too much light, a 12 volt bulb can be used.

Type FS (Ford). This type gauge is designed to be mounted on the steering column. The second cylinder head stud on the left of the engine should be removed and the special cylinder head bolt screwed in place. The bulb should then be inserted in the socket in the bolt and the knurled nut tightened. A special clamp is provided to tap the tail light lead at a point near the lighting switch (on the lower end of the steering column). This clamp is provided with a pointed set screw which pierces the insulation on the lead and makes contact with the conductor. The tail light lead and stop light lead are both contained in a braided cable and care must be used to connect the gauge lead to the tail light wire. The lamp in the gauge is replaced as directed above.



SERVICING:—It is not possible to repair these instruments and they must be replaced whenever they are found to be defective.

NAGEL TEMPERATURE GAUGES

MODELS SC, CM, DM, RP, LP, FH (FORD TYPE)

DESCRIPTION:—The Nagel Temperature gauges are of the electrical type. They consist of a dash unit or recording gauge calibrated to read in degrees of engine temperature, an engine unit mounted on the block or in the water outlet at the front of the engine and exposed to the heat of the engine, and an electrical connection or conductor between these two units. The current required to operate the gauge is taken from the battery of the car and the dash gauge is connected to the ammeter or lighting switch. The gauge automatically turns itself off when the engine is cold and for this reason it is not necessary to have a switch in the gauge circuit. All of the above types except the Model LP are illuminated by a bulb in the dash unit and a second lead is connected to the tail light terminal of the lighting switch so that the gauge lamp is lighted whenever the car lights are on.

OPERATION:—These gauges are of two distinct types, the Resistance type and the Thermostatic type. The Resistance type was not manufactured after May, 1929, and all new gauges are of the Thermostatic type. However, gauges will be found in service which operate on the Resistance principle.

Resistance Type Gauges. The dash unit of this type gauge consists of an armature to which a pointer or indicator is attached and which is mounted within the field of the two electromagnets. The current through one of these electromagnets is constant (with constant voltage) tending to draw the indicator toward the 'Hot' end of the scale. The other electromagnet is in series with the engine unit which consists of a resistance which has a very high temperature coefficient of resistance; that is, the resistance of the engine unit will be very low when the engine is cold allowing a large current (relative to the other electromagnet) to flow through the electromagnet and drawing the indicator over toward the 'Cold' side of the scale. However, the resistance of the engine unit increases rapidly as the temperature of the engine increases, cutting down the current through its electromagnet and allowing the other electromagnet to draw the indicator over toward the 'Hot' end of the scale. The gauge is calibrated to indicate 'Hot' when the temperature of the engine reaches 200°F. (slightly below the boiling temperature).

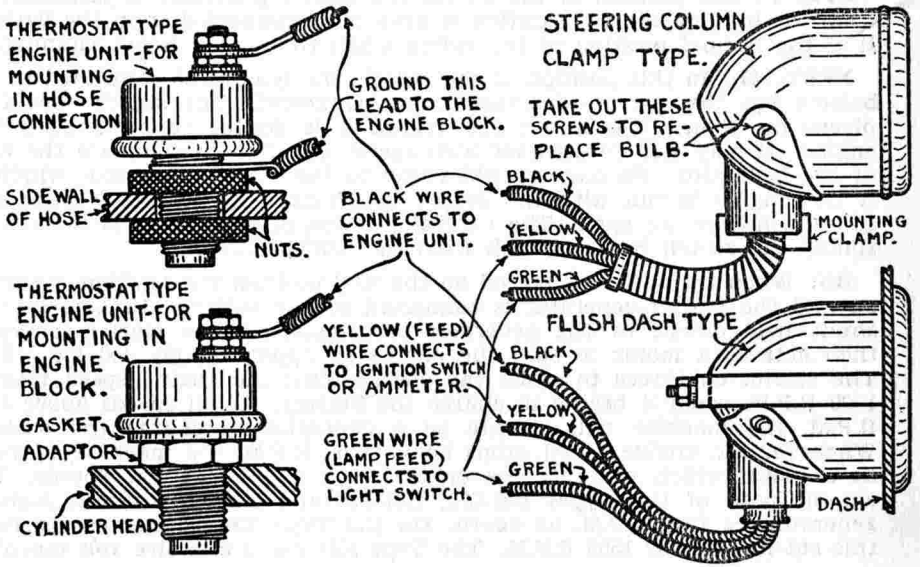
NOTE:—On the gauge used on Durant (1928) a thermostat in the engine unit was set to open the resistance circuit when the engine temperature reached 207°F. with the pointer ⅛ inch below the red spot. This caused the pointer to jump suddenly into the 'Hot' section of the dial and clearly differentiated between the normal and 'Hot' readings. These gauges will indicate 'Hot' when the gauge is defective.

Thermostatic Types. The dash unit of this type is simply a miliammeter which measures the current in the gauge circuit. The engine unit consists of four thermostats and four sets of contacts with resistances connected between them. When the engine is cold the circuit is open and no current flows through the dash unit. When the engine begins to warm up the first set of contacts close, allowing current to flow through the dash unit and all the resistance in the engine unit. This causes the pointer to move to the 'Cold' position on the scale. As the temperature of the engine rises, the thermostat blades close the contacts consecutively, cutting out the resistance by steps and allowing more current to flow through the dash unit. This causes the pointer to move along the scale. When the fourth thermostat blade closes the contacts all the resistance is cut out of the engine unit and the pointer moves to the red portion of the scale, indicating 'Hot'. The standard setting of these gauges is: 'Cold'—under 120°F.; 'Normal'—from 120°F. to 197°F.; 'Hot'—above 200°F.

SPECIAL NOTE:—The dash units and engine units of the Resistance Type and Thermostatic Type gauges are not interchangeable. The models are similar in appearance and the model numbers have been continued except that the new gauges of the Thermostatic Type are known as 'Series T'. The engine units of the Thermostatic Type are equipped with a nut and binding post instead of the Fahnestock clip used on the Resistance Type and all Thermostatic Type dash units have a tag attached marked 'Series T'.

MOUNTING:—Dash units are designed for steering column mounting, clamp mounting on the dash, and flush dash mounting. It is very important the dash unit be properly grounded (Resistance Type—the Thermostatic Type is not grounded). In steering column mounting it will be sufficient to scrape the paint from under the mounting clamp band on the steering column. Where the dash unit is clamped on the dash, the ground will be taken care of by the mounting clamp screw on metal dash providing the screw makes contact with the dash directly.

The engine unit can be mounted in the hose connection at the front of the engine (the water outlet at the top of the radiator) or directly on the cylinder block through the use of a special adapter. The hose should be removed from the engine and cut with the special cutter furnished with the gauge. The engine unit is mounted on the hose (see illustration) and grounded to the motor block by a separate ground wire. When the engine unit is mounted on the engine block, by drilling a 23/32 inch hole and tapping for a ½ inch pipe plug, no separate ground need be provided. The terminal on top of the engine unit should be connected to the black lead



from the dash unit. The engine unit ground is very important.

The yellow lead from the dash unit is the feed wire and should be connected to any live terminal of the car circuit, usually the ammeter or feed terminal of the ignition switch. On illuminated models the third lead, a green wire, should be connected to the tail light terminal of the lighting switch so that the gauge lamp will be lighted whenever the car lights are on. The Model LP is not illuminated and this green wire is not used. The lamp bulb can be removed and replaced by taking out the two screws on the back of the instrument, which will release the plate on which the bulb is mounted.

TROUBLE SHOOTING:—If the temperature gauge does not register correctly, check the ground at the dash unit and engine and examine connections. On flush dash mounting type gauges see that connections are properly made. The engine unit should be connected to the terminal marked 'E' and the feed wire to the terminal marked 'S'. The indicator can be checked by running the engine with retarded spark with the radiator covered until the cooling water boils. Check to see if the gauge reads 'Hot'. If indicator fails to register, disconnect the lead at the engine unit and ground to the engine block. If the pointer goes to 'Hot', the dash unit is probably all right. If the dash unit fails to register, it is defective or the lead wire is open. These instruments cannot be repaired and must be replaced when they are found to be defective.

OWEN-DYNETO STARTER-GENERATOR

TYPES KB-873, KB-897, KB-878 AND KB-890

OUTBOARD EQUIPMENT ON JOHNSON, CAILLE AND OUTBOARD CORP. ENGINES

DESCRIPTION:—The Owen-Dyneto Starter-generator for outboard engines is a six pole, compound wound machine. The armature is keyed directly on the upper end of the crankshaft and serves as the engine flywheel. It revolves within the field frame which is mounted on the upper end of the crankcase. The two main brushes and a movable control brush are mounted on the brush ring which is centered on the upper end of the field frame by six small tongues. A battery charge regulator is also mounted on the brush ring. The ignition unit is mounted on the upper end of the shaft under the cover plate of the starter-generator.

OPERATION:—The starter-generator is controlled by a three position 'slide bar' type switch. The three positions of the switch are:

OFF. In this position of the switch the starter-generator is disconnected from the battery and the ignition is likewise disconnected from the battery. It is the normal position of the switch when the engine is not running.

NEUTRAL. In this position of the switch, the ignition is connected to the battery but the starter-generator is not connected. The switch should be placed on 'Neutral' when for any reason it is desired to hand-crank the engine. It may also be used for high speed operation to eliminate the drag of the generator. No damage will occur to the starter-generator windings if the engine is run with the switch in 'Neutral' as both the series and shunt windings are open. The neutral position of the switch is secured by sliding the switch bar 3/16 inch from the 'Off' position.

ON. When the switch is placed on the 'On' position the ignition is turned on and the starter-generator is connected to the battery. In addition the shunt field circuit of the generator is completed. The starter-generator then acts as a motor to spin the engine at approximately 400-450 R.P.M. The starter continues to assist the engine until the engine speed reaches 1000 R.P.M. when it begins to charge the battery. At all speeds above 1000 R.P.M. the machine will operate as a generator to charge the battery. Whenever the engine speed drops below 1000 R.P.M. the machine operates as a motor which prevents the engine from stalling at low speeds. The cut-in speed of the Types KB-873, KB-878 and KB-897 six volt starter-generators is 1000 R.P.M. as above. On the Type KB-890 starter-generator this cut-in speed is 1500 R.P.M. The Type KB-890 is a twelve volt machine.

The generator output is controlled by an Owen-Dyneto 'Battery Charge Regulator' operating in conjunction with the third brush shunt field control. The control brush or 'third brush' can be shifted on the brush ring to change the generator output. The control brush should be shifted in the direction of armature rotation to increase the charging rate and in the opposite direction to decrease the charging rate. The Battery Charge Regulator is fully covered on a separate page. See Generators.

Generator Performance Data

Types KB-873, 878, 897

Amperes	Volts	R.P.M.
0	6.3	1000
16	7.6	2500
13	7.4	4500

Type KB-890

Amperes	Volts	R.P.M.
0	13	1500-1600
9	14	3500
8	14	4500

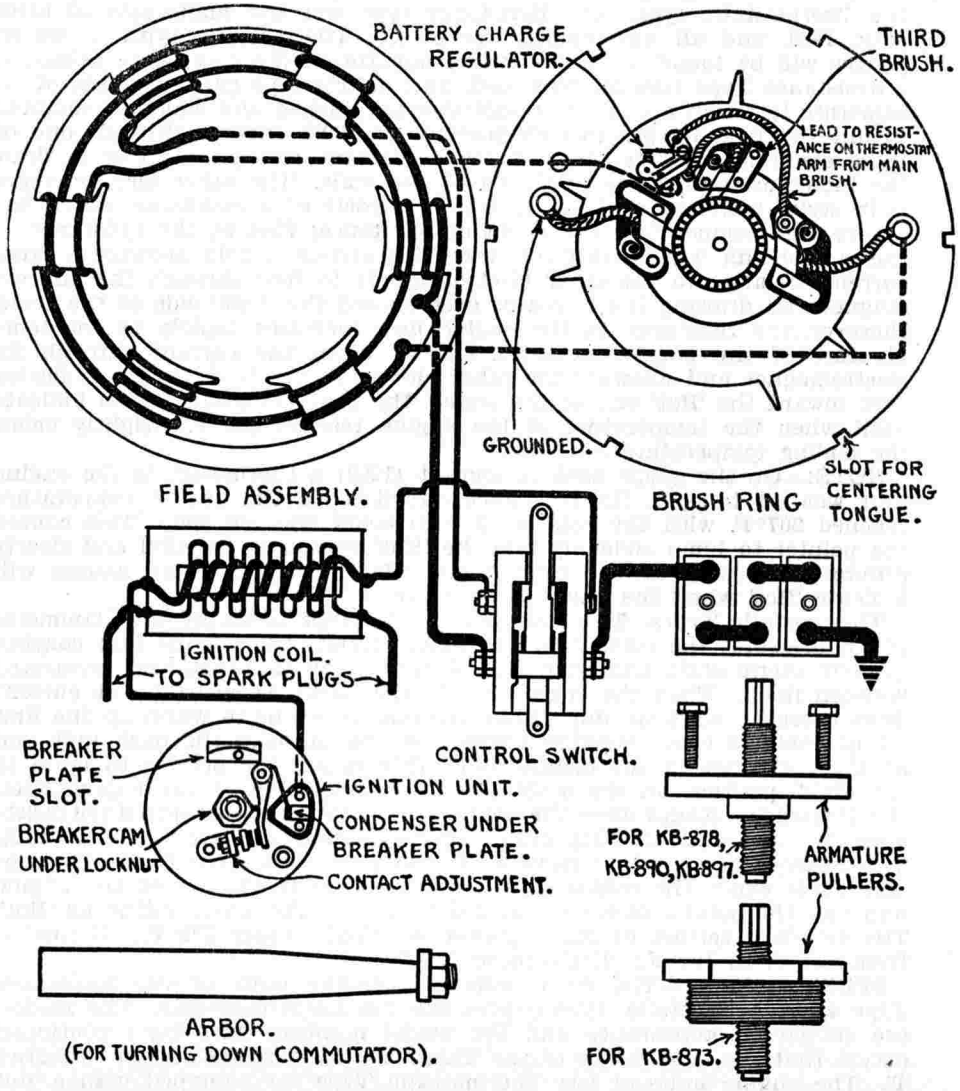
Starter Performance Data

Types KB-873, 878, 897

Torque	R.P.M.	Volts	Amperes
4 lb. ft.	400	6	65
27 "	Lock	5.5	290

Type KB-890

Torque	R.P.M.	Volts	Amperes
14 lb. ft.	400	11	130
35 "	Lock	9.5	330



OWEN-DYNETO STARTER-GENERATOR

TYPES KB-873, KB-897, KB-878 AND KB-890

OUTBOARD EQUIPMENT ON JOHNSON, CAILLE AND OUTBOARD CORP. ENGINES

MOUNTING:—The starter-generator must be disassembled before it can be removed from the engine. To remove starter-generator, perform the following operations in order:

1. Remove the cover. Take out the six screws that hold the cover in place on the field frame (Types KB-878, 890) or loosen the clamping screw (Types KB-873, 897). Raise the cover slightly and disconnect the spark advance control wire from the ignition mounting plate and the ignition coil lead from the breaker assembly. Then lift the cover from place.

2. Remove the ignition unit. Mark the position of the breaker plate on the armature (so that it may be reassembled in the same position without disturbing timing). Insert a screwdriver through the opening of the breaker plate and take out the six screws mounting the ignition unit on the end of the armature shaft. The ignition unit may then be lifted off.

3. Remove the hand cranking pulley (Types KB-873, 897, used on Johnson engines only). On the Type KB-873 the pulley is mounted on a split sleeve which screws into the armature hub and is held in place by a taper plug in the armature hub. The taper plug is locked in place by a nut on the stud which projects up through the pulley from the plug. To remove this type pulley, loosen the nut on the stud in the center of the pulley and tap stud down to loosen the taper plug. The pulley can then be unscrewed. The split sleeve has a right hand thread. On the Type KB-897 the pulley is mounted on a stud which is mounted on the end of the armature shaft by six screws. To remove pulley, take off the nut and cam on the stud bolt and lift pulley from place.

4. Remove the Brush Ring assembly. Take out the three screws which mount the brush ring on the field frame. Remove the two terminal stud nuts on the main brush leads and disconnect the shunt field coil lead at the regulator. The brush ring can then be lifted off.

5. Remove the Armature. The armature can be withdrawn after the nut which holds it in place on the crankshaft has been taken off. Several special armature pullers have been developed by the Owen-Dyneto Corporation for this purpose.

6. Remove the Field Frame Assembly. The field frame is mounted on the crankcase by four machine screws. These screws are accessible after the machine has been disassembled as directed above.

NOTE:—Since the armature is designed to be mounted on the crankshaft there is no armature shaft. If the armature is to be mounted in a lathe to turn down the commutator a special arbor must be used. This can be secured from the Owen-Dyneto Corporation.

IGNITION

OPERATION:—The ignition unit is of standard automotive design with a single lobe cam mounted on the crankshaft revolving at engine speed. The coil for two cylinder ignition is of the two spark type with both ends of the secondary brought out to high tension terminals which are connected to the spark plugs. Both cylinders fire simultaneously once in each revolution of the crankshaft. On four sylinder engines a double coil is used with two primaries and two secondaries which terminate in four high tension terminals. One coil fires the two upper cylinders and the other coil fires the two lower cylinders. Two breakers are used, each breaker controlling one coil. Both breakers are mounted on the breaker plate and operate on the same cam. The condensers for the breakers are mounted under the breaker plate.

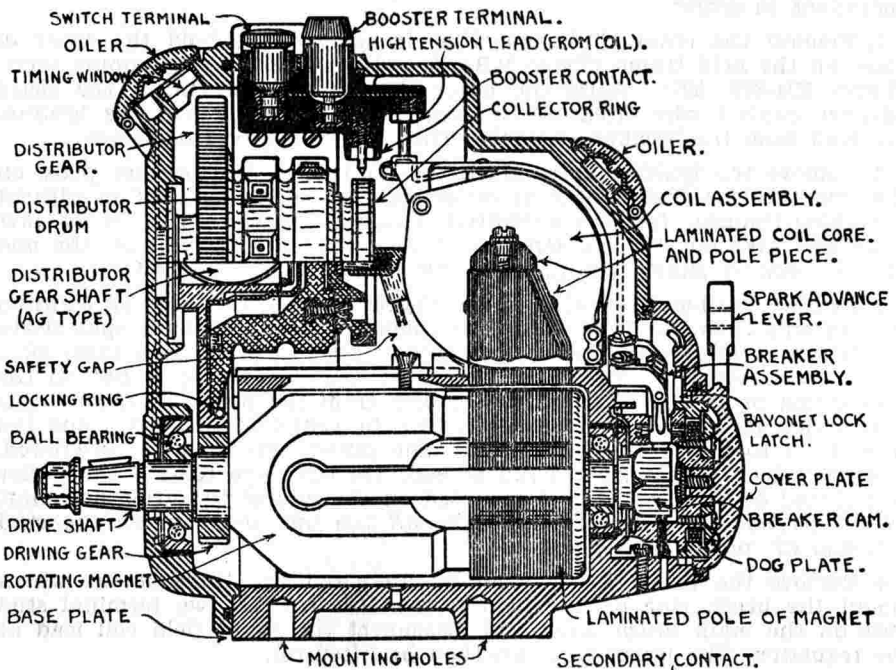
TIMING THE ENGINE:—To set the ignition timing, turn the engine over until the pistons reach top dead center (the extreme outer end of the stroke). Fully retard the spark advance. Loosen the locking nut on the upper end of the breaker shaft and carefully locate the cam so that contacts are beginning to open. Tighten the locking nut and connect the coil secondary leads to the spark plugs. With the spark advanced the contacts will be wide open at top dead center. Breaker contact gap should be .022-.025 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud. Resurface contacts when necessary with a fine flat contact file or on a medium hard oilstone.

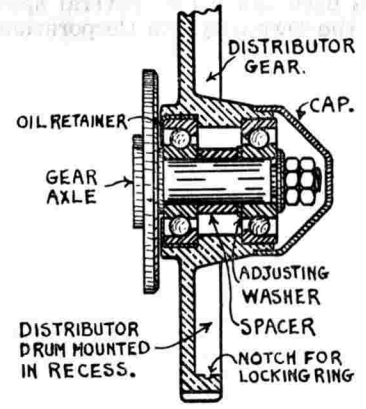
SCINTILLA AIRCRAFT MAGNETO

TYPES AG-8-D, AG-9-D, AG-12-D
TYPES V-AG-8-D, V-AG-9-D, V-AG-12-D

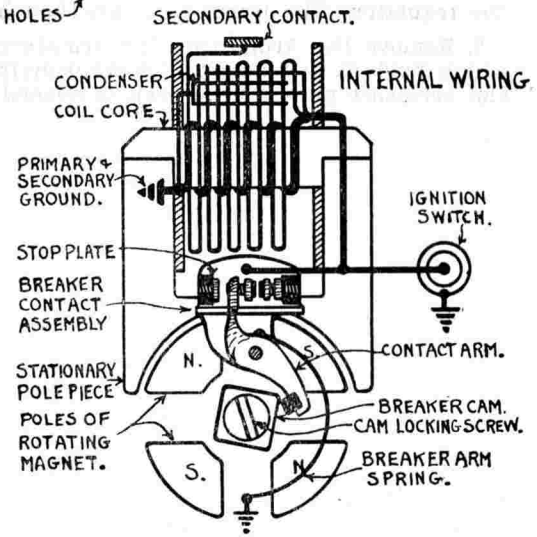
DESCRIPTION:—These models are Aircraft Magnetos. They are similar to other Scintilla Magnetos in being of the inductor type with rotating magnets and stationary coil. The rotating magnet has four poles and revolves within two laminated field poles. The coil is wound on a laminated core which is mounted directly on the upper ends of the pole pieces so that the magnetic field of the permanent magnets is completed through the coil core. The magnetic flux through the coil is reversed every time one of the poles of the magnet passes the pole piece, or four times in each revolution of the magnets. The magneto thus produces four sparks per revolution of the drive shaft. The interrupter cam is mounted on the end of the magnet shaft. The contacts and interrupter assembly are rigidly mounted on the breaker cage. The stationary contact is mounted on an insulated bracket at the top of the breaker cage. A bayonet lock and flat spiral bayonet lock spring are assembled on the breaker cage to hold the breaker assembly in the fully advanced position except when the magneto is retarded for starting by means of the timing lever. The advance lever is assembled in the end cover and is held in place by a central screw which is screwed in the end boss of the end cover. There are two dogs on the advance lever which engage in holes in the dog plate on the breaker cage assembly and permit a number of positions of the advance lever. A distributor drum is mounted directly above the rotating magnet and is driven by a distributor gear at one-half magnet speed. The high tension current is led from the coil through a carbon brush to the distributor drum terminals from which it is distributed to the spark plugs. The magneto is equipped for a 'booster' starting system. See paragraph on 'Booster'.

ROTATION:—The direction of rotation in which the magneto is designed to be driven is indicated by the arrow in the small disk on the frame at the distributor end of the magneto. The direction of rotation can be changed although this requires an almost complete disassembly of the magneto and the adjustment of the various parts. To change rotation, disassemble the magneto and pull the breaker cam. There are two keyways on the shaft marked 'D' for clockwise rotation and 'G' for counter-clockwise rotation. Place the woodruff key in the proper keyway, replace cam and pull cam fastening screw up tight. Then remove distributor cylinder and large distributor gear. The small dog screw in the face of the gear should be inserted in the hole marked 'D' for clockwise rotation and in the hole marked by 'G within a circle' for counter-clockwise rotation. The hole marked 'G without a circle' is only used for counter-clockwise rotation when no booster connection is fitted. Replace distributor gear and distributor cylinder. Take off the collector ring for booster current. There are two holes on the collector ring marked 'D' for clockwise rotation and 'G' for counter-clockwise rotation. The fastening screw should be inserted in the proper hole and this should line up with the line on the face of the distributor cylinder. Then remove cover and advance lever essembly. Unscrew dog plate fastening screws on breaker cage and remove dog plate. Carefully lift off bayonet lock latch and spring from breaker cage. Remove bayonet lock spring, turn spring over and replace. Remove breaker lever axle and breaker lever. Then take out stationary contact screw and fibre stop and interchange. Reverse breaker lever and replace so that contacts match up. Screw the breaker lever axle in and lock threaded end to breaker cage. Replace bayonet lock latch and spring and check to see that both ends of the spring are secured. Replace dog plate and dog plate screws, locking the screw heads to the dog plate. Mesh large distributor gear tooth marked 'D' with marked tooth of small gear for clockwise rotation and fasten end plate in place on housing. Replace contact assembly and rotate magnet until the number 'I' on the distributor gear appears in the opening for the timing window in the end plate and the contacts are just beginning to open. Reend plate with new timing marks to correspond to the timing marks on the distributor gear; change the rotation indicating arrow to indicate the new rotation and to change the number discs to indicate the new order of cable connections (these will not be the same). This entire operation is so intricate and requires so much care to insure the proper assembly of all units that the Scintilla Magneto Company recommends that the magneto be returned to the factory whenever it is necessary for the rotation to be changed. It should be attempted only as an emergency measure.





BALL-BEARING DISTRIBUTOR GEAR (V-AG TYPES).



BREAKER:—The breaker assembly is stationary while the breaker cam revolves

with the magnet shaft. Contacts separate .012 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is secured with breaker lever on the high point of the cam. Resurface contacts when necessary with a fine flat contact file. The clearance between the breaker lever and the fibre stop on the contact support directly behind the contact end of the breaker lever must be not less than .002 inch with the contacts fully open. If necessary the fibre stop can be filed to secure this clearance although if this is done care must be used to see that the breaker lever bears against the entire fac of the stop when the breaker lever is pressed back against it.

OILING:—There is an oiler with a hinged cover at each end of the magneto. The oiler at the drive end has two holes. Put 30 to 40 drops of oil in the drive end oilers when oil should appear at the overflow hole about one inch below the oil hole cover. One of these oil holes oils the drive end bearing while the other oils the distributor shaft on the AG models. This second oil hole is not used on the V-AG models with ball bearing distributor shaft. The oiler at the breaker end oils the other magnet shaft ball bearing. This oiler should be given 3 to 5 drops of oil. Any excess is to be avoided as it will work out in the breaker case. The wick at the bottom of the breaker cage should be saturated with heavy oil. The oiling should be done every 10 hours of operation.

TIMING:—The magneto should be mounted on the engine bracket with base cap screws which extend into the holes in the magneto base plate 7/16 to ½ inch. This is very important. Locating dowel pins are also used. These should be a snug fit in the magneto base. With magneto on base and magneto half of drive coupling locked in place, crank engine over until firing position of piston No. 1 with spark fully advanced is reached. The manufacturer's specifications must be followed. Then carefully turn magneto shaft in the direction of rotation until No. 1 can be seen in the timing window. The line opposite the 'I' mark should coincide with the mark on the timing window when the contacts are just opening. If no timing window is used, remove the distributor gear cover and line up the supplementary marks on the distributor gear and the end plate. Couple the magneto to the engine in this position and connect the terminal marked No. 1 to the spark plug in No. 1 cylinder. The remaining magneto terminals should be connected in numerical order to the spark plugs in accordance with the firing order of the engine.

SPARK PLUGS:—The spark plug gap will depend entirely on the type of engine on which the magneto is used. The manufacturer's specifications should be followed. The magneto is fitted with a safety gap in which the spark jumps from an extension of the high tension brush assembly to a ground screw on the frame. This gap is set at ⅜-½ inch.

BOOSTER STARTING:—The magnetos of this series are equipped for use with booster current to assist in starting. This consists of an extra terminal on the top of the frame marked 'H' to which a supplementary high tension current source is connected. This will normally be a small hand magneto which is turned over at speed by the operator during the cranking operation. This booster current jumps from the terminal screw to the booster collector ring on the end of the distributor drum from which it is led to auxiliary terminals on the distributor drum directly behind the regular terminals. From these terminals the spark jumps to the cable electrodes and is distributed to the spark plugs. Due to the position of the terminals on the drum the booster current will lag behind one cylinder so that when the timing mark for cylinder No. 1 is visible in the timing window the booster current will be distributed to No. 12 cylinder.

TYPE V-AG

The V-AG Magnetos differ from the AG series only in the mounting of the distributor gear.

On the AG series the distributor gear revolves on a plain bearing carried on an eccentric shaft to permit the adjustment of the distributor gear mesh. This will probably not be required unless one of the gears has been replaced. In this event the fastening screws on the shaft flange should be loosened and the shaft drifted slightly to the right (viewed from the drive end) to raise the large gear or to the left to lower the large gear. The flange mounting screws should then be tightened and locked to the outside face of the end plate.

On the V-AG series the distributor gear is carried on two plain ball bearings. The bearings are packed with grease which is retained by brass caps at each end of the assembly and require no attention between overhauls. The assembly endplay is adjusted by means of a spacer and adjusting washers between the two bearings.

TIMING GAUGE

FOR USE ON CHRYSLER, DODGE, DE SOTO, AUSTIN

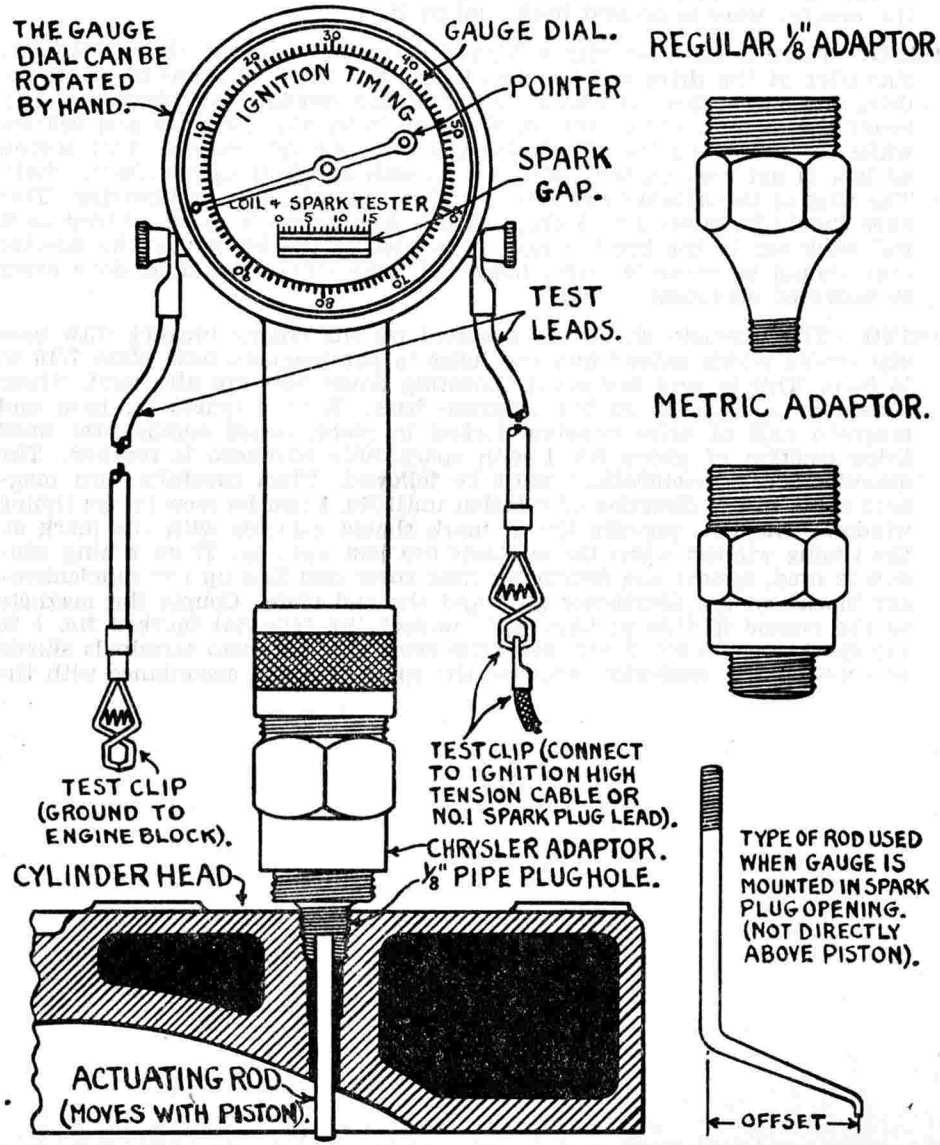
DESCRIPTION:—The timing indicator is a special micrometer gauge with a direct reading dial which is designed to be mounted on the cylinder head to measure the piston travel directly in thousandths of an inch as it approaches and leaves top dead center. It must be used on the car models listed above in setting the ignition as the flywheels on these car models are not marked and the specifications for ignition setting are given by the manufacturer in thousandths of an inch of piston travel for use with the micrometer gauge. The new type gauge is fitted with a visible spark gap so that the opening of the contacts can be checked.

OPERATION:—The operating piston of the gauge is contained in the shaft which is designed to be screwed into the spark plug port in the cylinder head or in the opening in the cylinder head closed normally by a ⅛ inch pipe plug on engines where this plug is provided (the plug will usually be found in the cylinder head directly over No. 6 piston). Special adaptors for use with ⅞ inch S.A.E. spark plug, ½ inch pipe thread, 18 MM. Metric thread and the ⅛ inch pipe plug openings are furnished with the gauge. These adaptors are used in connection with rods which rest on the head of the piston and move with it and thus actuate the gauge piston. Straight rods are used when the gauge is mounted in the ⅛ inch opening directly over the piston and offset rods must be used when the gauge is mounted in the spark plug port which is not directly over the piston head. The gauge is calibrated in thousandths of an inch and one complete revolution of the indicator hand registers .100 inch. The limit of travel of the gauge is six complete revolutions of the indicator or .600 inch and care must be taken when the gauge is used that the rod does not engage the piston more than .6 inch before top dead center.

IGNITION SETTING, USING GAUGE:—In timing the distributor to the engine, first crank the engine over until piston to be used in timing is on compression stroke (see specific car data sheet—the piston used may be No. 1, No. 4 or No. 6). Take out the spark plug or remove the ⅛ inch pipe plug in the cylinder head. Clean the carbon off the cylinder head. This is very important. Assemble the correct adaptor and rod on the gauge and screw the adaptor into the cylinder head. Turn engine over very slowly and see that the gauge indicator does not make more than six revolutions before top dead center. With the piston on top dead center set the gauge dial at zero. Connect the high tension lead from the coil to one of the spark gap terminals on the gauge. Ground the other gauge terminal to the engine and turn on the ignition. The first type gauge used on Chryslers was not equipped with this spark gap and it is necessary to use a test lamp connected in the primary circuit to check contact opening whenever this type gauge is used. Then turn engine over until, with the piston approaching top dead center on compression stroke, the gauge reading indicates the firing position (see car data sheet). If it is desired the gauge dial may be moved from the dead center position a number of calibrations equal to the ignition setting before top dead center, in which case the firing position will be reached when the dial indicates zero. This is likely to be confusing. Then set distributor so that contacts are just opening (at which point a spark will appear in the spark gap on the gauge).

SYNCHRONIZATION OF CONTACTS, USING GAUGE:—The timing gauge can be used to synchronize contacts on distributors using double breakers if it is not desired to use the regular synchronizing tools. To synchronize contacts on a six cylinder engine (distributors with two sets of contacts opening alternately at intervals of 60 degrees corresponding to 120 degrees of crankshaft rotation) after the distributor has been timed to the engine, crank the engine over 180 degrees until the piston again approaches top dead center on the exhaust stroke. Repeat the timing operation by stopping the crankshaft when the gauge reading indicates the firing position and shift the second set of contacts (mounted on the movable sub-plate) until they open, when a spark will be visible in the spark gap. Full details on distributor design and synchronization will be found on 'Distributor' pages.

In synchronizing contacts on eight cylinder engines (with two sets of contacts opening alternately at intervals of 45 degrees corresponding to 90 degrees of crankshaft rotation) it will be necessary to move the timing gauge to the next firing cylinder after the distributor has been timed to the engine and repeating the timing operation except that the disributtor should not be disturbed and the second set of contacts should be adjusted by shifting the movable sub-plate until the spark is seen in the spark gap on the gauge. The spark gap can also be used to test the intensity of the ignition spark by varying the gap.



This gauge is Chrysler Tool No. DC-150. It is manufactured by the Miller Tool and Manufacturing Company, 1725 Sixteenth Street, Detroit, and is distributed by the Weidenhoff Company in Chicago.

OWEN-DYNETO AUTOMATIC STARTING

MODEL 21658

DESCRIPTION:—The Owen-Dyneto automatic starting device consists of an electrically operated starting switch controlled by a Vacuum Relay. The starting switch containing the main switch contacts is actuated by a solenoid connected to the ignition switch so that the solenoid is energized whenever the ignition switch is turned on. The solenoid circuit is completed through a set of contacts in the Vacuum Relay. These contacts are normally closed with the engine stopped. In operation when the ignition switch is turned on, the starting switch is energized, the main switch contacts are closed, completing the starter circuit, engaging the Bendix drive and cranking the engine. As the vacuum in the intake manifold builds up, the diaphragm in the vacuum relay opens the solenoid circuit contacts. There are a second set of contacts in the switch case, connected in parallel with the relay contacts, which remain closed as long as the starter is cranking the engine. These contacts are controlled by a horseshoe magnet which opens the contacts as soon as the engine begins to fire and the starter drive is disengaged (the current drawn by the starter decreases when cranking stops which allows the horseshoe magnet to open the contacts). This opens the solenoid circuit and breaks the starter circuit.

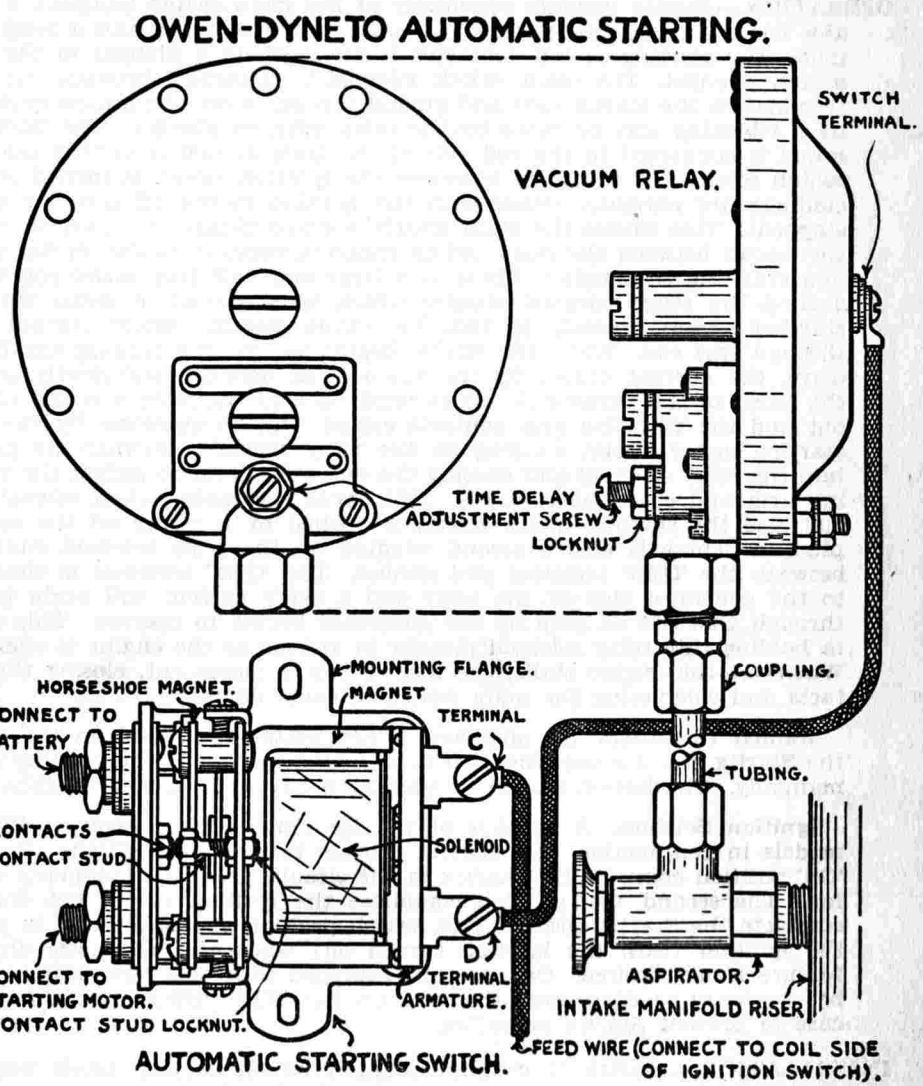
As long as the engine is running and a vacuum exists in the manifold the starter will not operate. Whenever the engine stops, the diaphragm in the Vacuum Relay will close the contacts, completing the solenoid circuit and cranking the engine. The Vacuum Relay is fitted with a time delay adjustment to permit a short interval between stalling of the engine and cranking so that the Bendix drive will not engage while the flywheel is still rocking (see paragraph on Adjustment).

INSTALLATION:—The magnetic switch is designed to be mounted on the starter field frame. The left hand main terminal should be connected to the car battery. The right hand terminal is connected to the starter terminal through a short busbar or strap connector. The right hand solenoid terminal is connected to the coil terminal of the ignition switch (this connection may be made to the gasoline gauge or any other 'hot' point connected directly to the ignition switch. The left hand solenoid terminal is connected to the Vacuum Relay (see illustration).

The Vacuum Relay is mounted on the manifold and is connected to the 'Aspirator' (manifold connection) through a short piece of ⅛ inch pipe. It is necessary to drill and tap a ⅛ inch hole in the manifold directly above the carburetor in order to install the Aspirator.

ADJUSTMENT:—The magnetic switch is correctly adjusted at the factory. However, an adjustment is provided so that the original setting can be changed if the starter gives evidence of faulty operation by interrupted cranking (repeated attempts to crank the engine at irregular intervals) or if the starter spins after the engine has begun to fire. To check and adjust switch operation, remove high tension cable, open throttle wide, take off switch cover, loosen lock nuts on contact screw. With ignition turned on, turn screw slowly clockwise (right hand direction) until starter cranks engine without interruption. Tighten adjustment lock nuts and test setting. If starter spins after engine begins to fire, loosen lock nuts and turn contact screw slowly counter-clockwise (left hand direction) while the starter is spinning until contacts open. Then test for interrupted cranking. The extreme left hand or counter-clockwise setting of the contact screw will cause interrupted cranking, while the extreme right hand or clockwise setting will result in the starter spinning. The correct setting will be found between these two positions. All tests should be made after the engine has been thoroughly warmed up.

Time Delay Adjustment. The Vacuum Relay is correctly adjusted at the factory so as to provide a short interval of time between the stalling of the engine and the closing of the relay contacts in order to permit the engine to stop rocking before the starter is engaged. If the time delay adjustment is too short the starter will spin and will not engage the Bendix drive. This can be remedied by increasing the time lag or delay. Time delay setting is adjusted by a screw on the back of the Vacuum Relay. The throttle should



be open whenever time delay is checked in order to overcome any vacuum in the intake manifold. Correct time delay should be one to two seconds. To increase the time delay, loosen the lock nut on the adjustment screw and turn screw in (clockwise) until correct interval is obtained. To shorten or decrease the time delay, turn adjustment screw out (counter-clockwise) until correct interval is obtained. When satisfactory adjustment is obtained tighten the lock nut to hold adjustment.

STARTIX

DESCRIPTION:—Startix is an automatic magnetically operated switch. It will be found installed on a number of 1932 car models as original equipment. It is used in conjunction with starters equipped with Bendix drives and is designed to crank the engine automatically whenever the ignition switch is turned on. It will also crank the engine whenever the engine stalls with the ignition switch on.

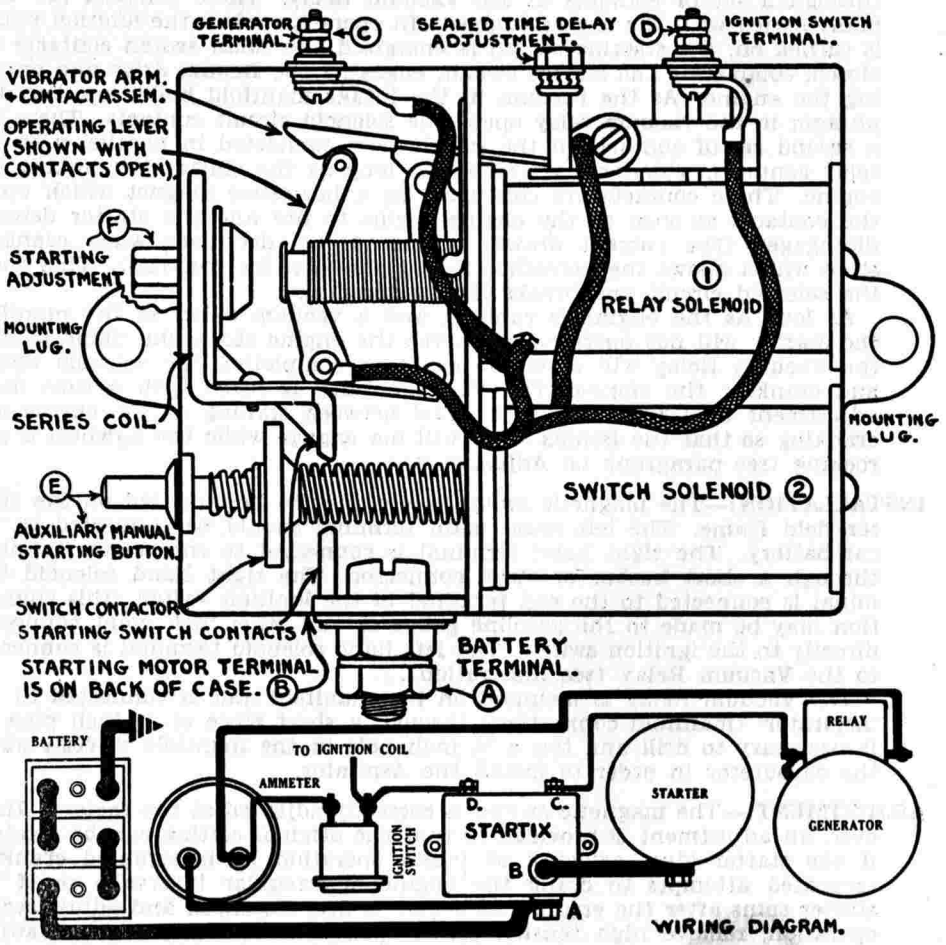
OPERATION:—Startix consists essentially of the main switch contacts, a movable contactor and two solenoids, a main switch solenoid, and a relay solenoid. The starting switch contactor is mounted on a plunger in the main switch solenoid. The main switch solenoid is connected between the 'IGN' terminal on the startix case and ground through a set of contacts controlled by a vibrating arm operated by the relay solenoid plunger. The 'IGN' terminal is connected to the coil side of the ignition switch so that the main switch solenoid is energized whenever the ignition switch is turned on (the contacts are normally closed with the ignition switch off and the engine stopped). This causes the main switch solenoid plunger to move in closing the circuit between the main switch contacts, completing the starter circuit and cranking the engine. There is a large one half turn series coil wound around the relay solenoid plunger which is connected in series with the starting switch contacts so that the entire starting motor current flows through this coil. When the engine begins to fire, disengaging the Bendix drive, the current drawn by the starter will decrease sufficiently so that the effect of this series coil (which tends to hold the relay solenoid plunger out and the vibrating arm contacts closed) will be overcome by the outer starting motor circuit winding on the relay solenoid drawing the plunger into the relay solenoid and causing the operating lever to deflect the vibrating arm and open the contacts. This opens the main switch solenoid circuit and the starting motor circuit is opened by a spring on the solenoid plunger. There is also a second winding on the relay solenoid connected between the 'GEN' terminal and ground. The 'GEN' terminal is connected to the generator side of the relay and a small current will begin to flow through this coil as soon as the generator begins to operate. This assists in holding thte relay solenoid plunger in as long as the engine is operating. Whenever the engine stalls, the relay solenoid moves out, closing the contacts and completing the main switch solenoid circuit.

Manual Operation. An auxiliary starter button is located on the end of the Startix case for use whenever it is desired to operate the starting switch manually. The button should be pressed firmly and released quickly.

Ignition Settings. A number of the ignition switches used on 1932 car models in conjunction with Startix provide two switch positions. The first 'On' position connects the Startix in the circuit, providing automatic cranking. The second 'On' position completes the ignition circuit but does not complete the Startix circuit. This switch position should be used in setting the ignition (with the ignition turned on) when the automatic cranking feature is not desired. On cars not equipped with this type switch it will be necessary to disconnect the wire on the 'IGN' terminal of the Startix case to prevent Startix operation.

INSTALLATION:—Startix is usually mounted on the engine block near the starter, or on the dash. The case is grounded and a separate ground wire must be run from the case to the car frame or engine block whenever the Startix is mounted on a wooden dash or other insulated mounting. Connections should be made as indicated on the diagram. In making connections to the main terminals care should be taken not to twist the main terminal posts as this may interfere with correct operation of the starting switch by affecting the alignment of the switch contacts.

ADJUSTMENT:—A starting adjustment is provided on the end of the Startix case directly in front of the relay solenoid plunger. This adjustment consists of a slotted screw held in position by a locknut. It is designed to correct interrupted cranking (repeated attempts to crank the engine) or spinning of the starter after the engine has begun to fire and the Bendix drive has been disengaged. The extreme outward (counter-clockwise or left) position of the adjustment screw will cause interrupted cranking while the extreme inner (clockwise or right hand) position of the adjustment screw



will result in the starter spinning. The correct adjustment will consist in finding a position between these two extremes which will result in satisfactory starter operation. To set Startix adjustment, first disconnect coil high tension lead at center terminal of distributor cap (to prevent engine firing). Loosen locknut on adjustment screw, turn ignition on and while starter is cranking engine determine interrupted cranking position of adjustment screw by turning screw slowly to left or counter-clockwise until interrupted cranking begins. Tighten locknut slightly and make a mark on the case in line with the screw slot. If adjustment is being made because of interrupted cranking, turn screw slowly to the right until starter cranks engine steadily and make the mark at this point. Then connect coil high tension lead so that engine will fire, disconnect wire on 'GEN' terminal of Startix case, turn on ignition and turn adjustment screw to right or clock-

wise until starter spinning occurs after engine begins to fire. Then turn adjustment screw to left or counter-clockwise until a click is heard indicating the opening of the starting switch contacts. Tighten the locknut and check this point by operating the Startix by turning ignition switch on. The starting motor should begin to slow down as soon as the engine begins to fire. Mark position of adjustment screw slot by a line on the case. The final setting of the adjustment screw should be midway between the two lines on the case (where the lines are less than 180° apart), or one quarter turn or 90° from the 'starter spinning' reference line (when the two lines are more than 180° apart). Lock the adjustment screw by securely tightening the locknut.

Time Delay Adjustment. There is a sealed 'Time Delay Adjustment' screw on the top of the Startix case. This adjustment is set and sealed at the factory and should not be disturbed. It is designed to provide a short interval of time between the stalling of the engine and the automatic cranking operation to prevent damage to the Bendix drive through engagement of the Bendix while the engine crankshaft is rocking.

TROUBLE SHOOTING:—Failure of the generator or a short-circuit in the line between the 'GEN' terminal on the Startix and the generator will be evidenced by a clicking sound caused by the meshing contact of the Bendix drive pinion and the flywheel. This may be corrected temporarily to enable the car to be driven to a service station by disconnecting the wire on the 'IGN' terminal on the Startix case rendering the Startix inoperative. Correct by checking line, checking generator connections, cleaning generator commutator, checking ground, and, in some cases, advancing engine idling speed slightly where engine idles at so low a speed that generator will not operate the relay solenoid.

THERMOSTATIC SAFETY DEVICE:—There is a thermostatic control incorporated in the Startix which will open and close the circuit (this will be evidenced by a clicking sound) whenever the Bendix pinion sticks or jams in the flywheel for as long as the ignition is left on. This clicking sound will indicate that the ignition should be turned off and the Bendix pinion freed. No adjustment will be necessary on the Startix.

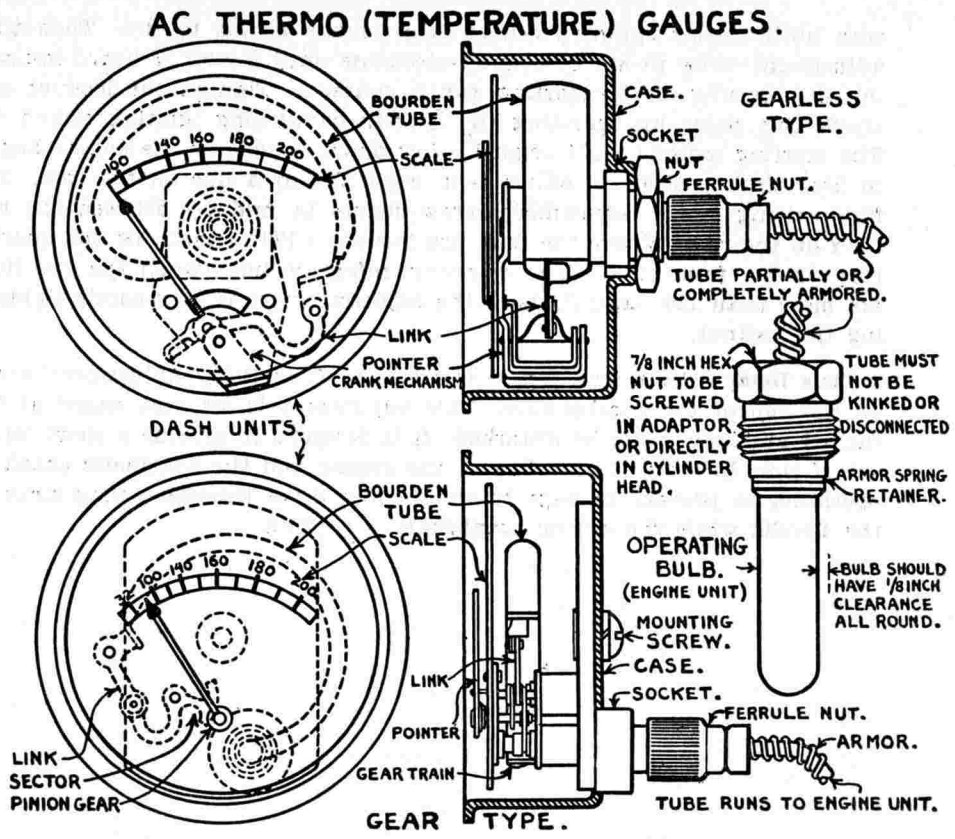
A C TEMPERATURE GAUGES

DESCRIPTION:—A.C. Temperature Gauges are of the Bourden tube type and consist of a dash unit in which the Bourden tube is mounted, together with the gauge pointer and connecting mechanism, and an engine unit or bulb. The units are connected by a hermetically sealed copper tube and the entire assembly is filled with a special liquid. The engine unit is mounted on the cylinder head and is immersed in the cooling water. As the temperature of the water increases the liquid in the bulb is vaporized causing a pressure to be exerted in the Bourden tube. The Bourden tube consists of a curved tube mounted rigidly at one end and connected to the gauge pointer through a crank mechanism or gear system at the other. The pressure within the Bourden tube results in a movement of the free end causing the pointer to move across the gauge dial. The gauge is calibrated in degrees of temperature.

INSTALLATION:—Gauges are made in three types: Gearless, in which the gauge pointer is connected to the Bourden tube through a simple crank mechanism; Gear Type,, employing a smaller Bourden tube which is connected to the pointer through a sector and pinion gear system to amplify the tube movement, and a Gear Type-Heavy Duty which is similar in design to the Gear Type.

Engine unit bulbs are designed in three sizes although for automotive use with a capillary tube length of less than 8 feet the smallest size, .365 inch in diameter and 1⅜ inches long, is used. Capillary tubing between the two units is completely armored or partially armored (at each unit). The engine bulb plug has a ⅝-18 N.F.-3 thread and may be screwed directly into a tapped hole in the cylinder head although it is recommended that an adaptor be used and that the hole in the cylinder head be tapped with a ½ inch pipe thread. The bulb must extend well into the liquid and should have at least ⅛ inch clearance all round.

SERVICING:—The entire gauge—dash unit, engine bulb, and capillary tubing—are assembled at the factory as one unit and no attempt should ever be made to disconnect the units or cut the tubing as this will render the gauge inoperative. The gauge requires no service operations and must be replaced when found defective. In installing the gauge, special attention should be paid to placing of the capillary tubing so that it is not kinked or bent in a curve of less than 3 inch diameter. Excess tubing should be formed in a coil and fastened to the dash.



AC FUEL PUMP

TYPE F COMBINATION FUEL AND VACUUM PUMP

DESCRIPTION:—The Type F Fuel Pump consists of two distinctly separate units, a fuel pump (upper section of the unit) and a vacuum pump (lower section of the unit) which are entirely separate except that the same operating linkage is used for both units. The Fuel Pump is similar in design and operation to the Type 5A (see earlier sheet), except that the pump is fitted with the new Air Dome over the delivery valve and the rocker arm spring location has been changed.

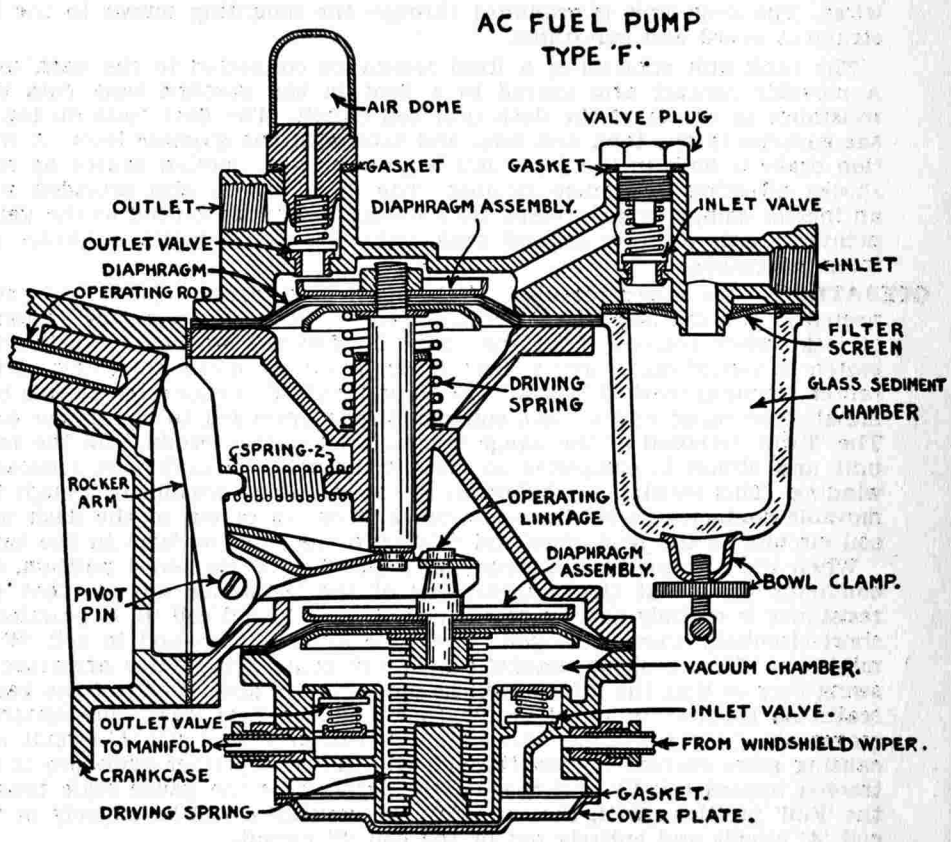
The Vacuum Pump unit is designed for windshield wiper operation and acts as a booster pump to ensure continuous windshield wiper operation even when the car is operated with wide open throttle and consequently low manifold vacuum.

OPERATION OF VACUUM PUMP:—The vacuum pump consists of a vacuum chamber containing the inlet and outlet valves and closed at the upper end by the pump diaphragm. A spring is assembled in the center of the pump under the diaphragm. The operating shaft on the upper surface of the diaphragm assembly is connected to the pump rocker arm through the linkage. In operation when the rocker arm is actuated by the eccentric on the camshaft the vacuum pump diaphragm is forced down, expelling any air in the pump chamber through the outlet valve into the manifold. When the rocker arm moves back (freeing the pump linkage), the driving spring under the diaphragm forces the diaphragm upward creating a vacuum in the chamber, opening the inlet valve and causing the windshield wiper to operate.

Whenever the engine is operated with the windshield wiper turned off the vacuum in the vacuum chamber will hold the diaphragm at its lowest position (with the driving spring compressed) and the vacuum pump will not operate. Whenever the manifold vacuum is higher than the pump vacuum the pump will likewise be inoperative and the windshield wiper will be operated by the manifold vacuum straight through the pump with both valves open. At all other times the pump operates as a booster in operating the windshield wiper.

SERVICING:—Servicing of the Fuel Pump section is exactly the same as in Type 5 pumps. Manufacturer recommends that no attempt be made to disassemble the vacuum pump section of the unit as special jigs are necessary to insure correct assembly. The pump should never be operated with the outlet from the vacuum chamber closed or plugged as the down stroke of the diaphragm which expels air from the vacuum chamber is positively driven by the rocker arm and damage will result. Likewise in mounting the pump on the engine, the eccentric or pushrod should be at the inner end of the stroke to avoid possible damage or distortion of the pump flange caused by the tension of the heavy vacuum pump driving spring.

TROUBLE SHOOTING:—Defective vaccum pump operation will be evidenced by faulty windshield wiper operation. If changing of windshield wiper does not correct trouble, the vaccum pump should be replaced. A punctured vacuum pump diaphragm may be detected by oil smoke in the exhaust. Check by disconnecting pump connection to manifold and noting presence of oil in vacuum pump discharge.



A C ELECTRIC GASOLINE GAUGE

DESCRIPTION:—The A.C. Electric Gasoline Gauge is of the balanced coil type and consists of two units, a dash unit or recording gauge and a tank unit or measuring device mounted on top of the gasoline tank. The dash unit mounted on the instrument panel consists of two coils mounted at an angle of 90 degrees. The gauge pointer is attached to an armature which is pivoted at the intersection of the coil axes. The dash unit is connected to the coil side of the ignition switch and to the tank unit through insulated wires. The dash unit is grounded through the mounting screws to the instrument board and car frame.

The tank unit consists of a fixed resistance connected to the dash unit. A movable contact arm geared to a float in the gasoline tank cuts this resistance in or out of the dash unit coil circuit. The float rests on top of the gasoline in the tank and rises and falls with the gasoline level. A friction brake is built in the tank unit to prevent wave motion caused by road shocks affecting the gauge reading. The dash unit is also provided with an inertia dampener to prevent road shocks being transmitted to the gauge pointer. Both dash units and tank units are standardized so units are interchangeable.

OPERATION:—The upper terminal of the dash unit marked 'Ignition' is connected to the coil side of the ignition switch (or to the 'auxiliary' terminal of lock switch coils) so that the gauge is operative whenever the ignition switch is turned on. Current flows through coil 'A' of the dash unit to the center terminal marked 'Tank'. The second coil 'B' is connected to this terminal. The other end of this coil winding is grounded to the gauge case. The 'Tank' terminal of the gauge is connected to the terminal on the tank unit and circuit is completed to ground through the tank unit resistance winding. This resistance winding in the tank unit is grounded through the movable contactor so that the resistance is cut in or out of the dash unit coil circuits as the float rises and falls with the gasoline level in the tank.

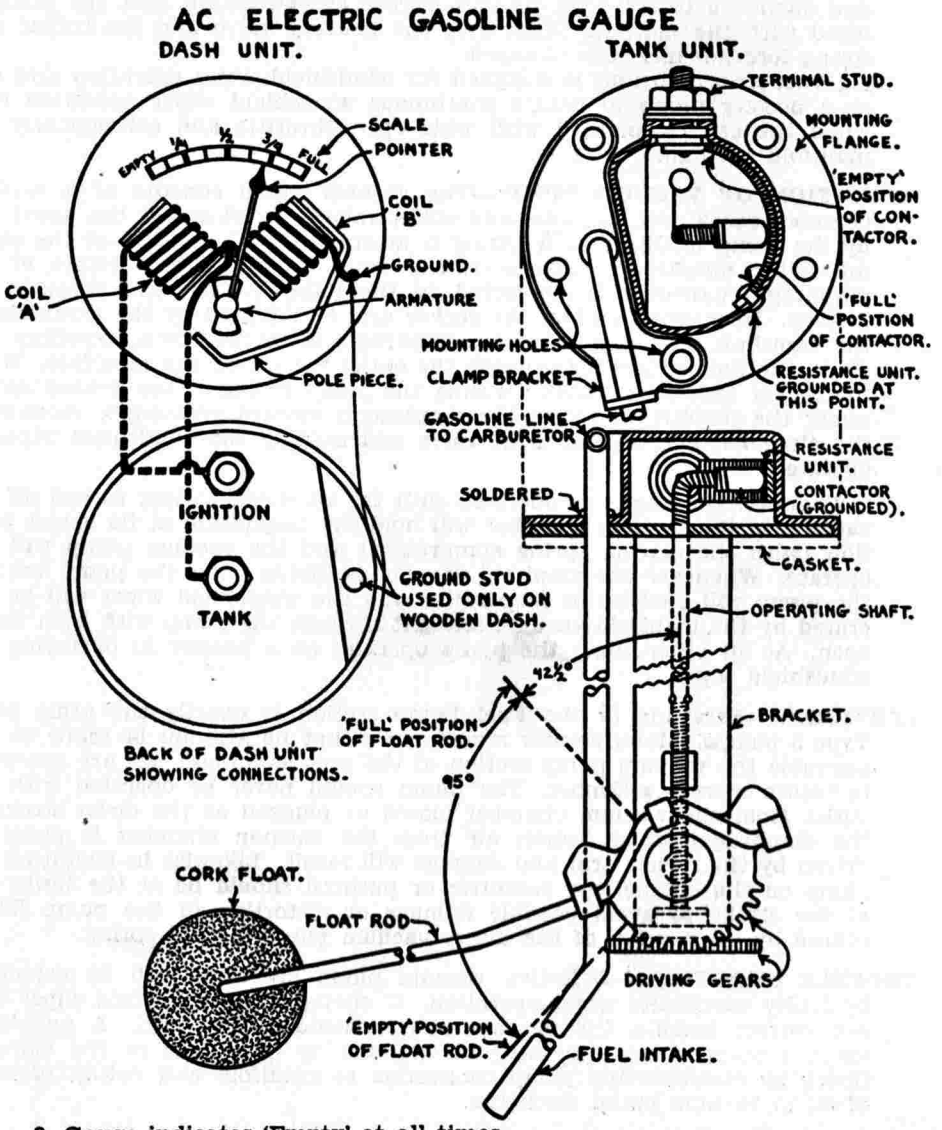
When the gasoline tank is empty with the float at its lowest position, the contactor will be at the terminal end of the resistance unit so that the resistance is entirely cut out of the coil 'A' circuit and coil 'B' is practically short-circuited. Current in coil 'A' will be at maximum and in coil 'B' at minimum. The resulting magnetic field will cause the pointer armature to swing over so that the pointer will be opposite the 'Empty' end of the gauge scale. As gasoline is added in the tank and the float rises, the contactor moves along the resistance unit adding resistance in the coil 'A' circuit and causing more current to flow through coil 'B'. The pointer armature is attracted toward coil 'B' and the pointer passes over the gauge scale toward the 'Full' position. With the tank full the resistance will be entirely in the coil 'A' circuit and entirely out of the coil 'B' circuit.

Since the gauge is of the balanced coil type, differences in the voltage of the car battery will have no effect on the accuracy of the gauge reading. Current consumption of the gauge is between 1/6 and 1/10 ampere and can be disregarded.

INSTALLATION:—Both the tank unit and dash unit are grounded and care must be taken whenever the units are installed or replaced that a ground is provided. On the tank unit it will be sufficient to remove paint and carefully clean the tank under the tank unit flange. Dash units designed to be mounted on a wooden dash or instrument board are provided with a ground stud which should be connected to the car frame.

TROUBLE SHOOTING:—Defective units should be replaced and servicing operations will be confined to locating trouble in dash unit or tank unit. Check gauge operation from following table:

1. Pointer does not move when ignition is turned 'on'.
   The line from the ignition switch to the dash unit is open. Check connections and supply new lead from switch to 'IGN' terminal on gauge.
2. Gauge indicates 'Full' at all times.
   The line between dash unit and tank unit is open. Check connections and replace line with insulated wire.
   Tank unit burned out. Replace tank unit.
   Tank unit not grounded. Check by supplying new ground from tank unit to car frame.



3. Gauge indicates 'Empty' at all times.
   Wires reversed on dash unit. See that connections are made as indicated above on diagram.
   Dash unit is not grounded. See that dash unit is properly grounded. Check by supplying special test ground to car frame. If dash unit does not register correctly, it must be replaced.

K-S 'TELEGAUGE' FUEL GAUGE

DESCRIPTION:—The K-S Telegauge is a hydrostatic gasoline gauge. The gauge actually measures the pressure due to the weight of the gasoline in the tank on a column of trapped air in the tank unit of the gauge. This is recorded by the height of the liquid column in the dash unit of the gauge. Since the height of the column depends upon the height of the gasoline in the tank the dash unit is calibrated to read directly in gallons. It should be remembered that there are three distinct units to the gauge; the dash unit or recording unit, the tank unit or pressure unit, and the air line which connects them. These will be taken up individually.

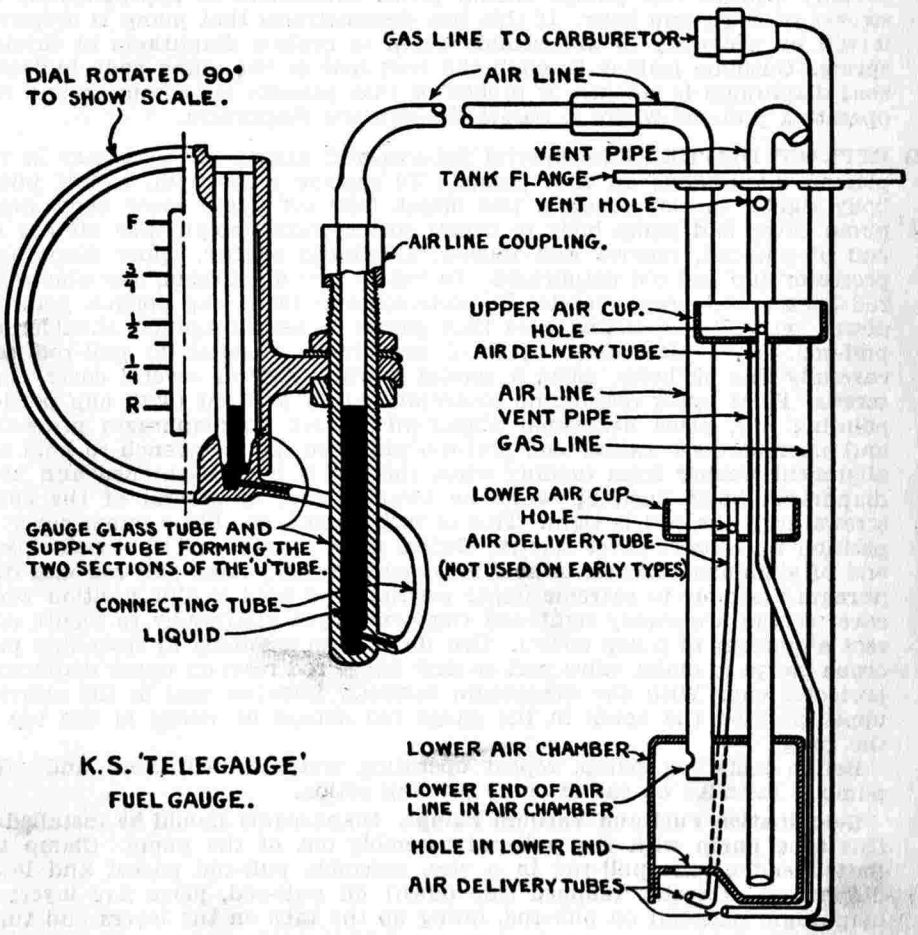
Tank Unit:—The tank unit consists essentially of an inverted cup mounted in the bottom of the gasoline tank and connected through an air-tight tube to the gauge connection on the top of the tank. The cup is closed by a plate at the bottom to prevent fuel surges affecting the operation but gasoline is free to enter the cup through a hole in the plate. A vent pipe to protect the gauge against high pressure extends down through the cup with the lower end (which is open) at the lowest portion of the cupped lower plate. The upper end is open to the air. It is purely a safety measure and since the lower end is normally covered by gasoline it has no part in the operation of the gauge. There is, however, an air supply tube which terminates in a cup at the upper end in the tank while the lower end is curved up under the bottom of the cup. This acts to renew the air supply in the cup by trapping gasoline in the upper air cup from which it runs down through the tube, drawing with it small bubbles of air. These bubbles find their way into the cup of the tank unit and maintain the air supply. When the cup is completely filled they escape around the edge and through the gasoline in the tank.

Air Line:—This consists of an air-tight copper tube connecting the terminals of the tank unit and the dash unit. It transmits the air pressure in the tank unit to the dash or recording unit where it displaces the red liquid in the gauge.

Dash Unit:—The dash unit consists of a glass tube open at the top and mounted directly behind the face of the gauge so that the height of the liquid can be seen. The lower end of the tube is connected to a brass supply tube which is connected at its upper end to the air line from the tank unit. The whole assembly is thus a 'U' tube filled with a red liquid and open to the air at one end and connected to the tank unit or pressure source at the other end. When the pressure at both ends of the 'U' are equal, as they will be when the gasoline tank is empty, the liquid will be of the same height in the two sections of the 'U'. This corresponds to the 'Empty' position of the gauge and the top of the column in the gauge glass should be opposite the 'Empty' figure on the gauge face. Most of the gauges do not show a '0' or empty position and the gauge will read 'R' indicating the reserve supply at the lowest position of the liquid.

OPERATION:—As the tank is filled with gasoline, the pressure of the gasoline tends to displace the air in the tank unit cup, driving it through the air line to the dash unit. Here it unbalances the two liquid columns, driving the liquid down in the supply tube and up in the gauge glass. The gauge is calibrated to read directly in gallons.

SERVICING:—The liquid in the dash unit should be opposite the lowest mark on the gauge with the air line disconnected at the top of the supply tube. To check, disconnect the air line and note the reading. The level of the liquid can be adjusted by using a toothpick to absorb excess or by adding additional liquid. This can be secured from the manufacturer and only genuine King-Seeley Telegauge liquid should be used for this purpose. The air line should then be dried out by connecting the dash end to a hand pump and pumping approximately 40 full strokes of air through the line. This should be done whenever the air line is disconnected for any reason. Do not use the air compressor line as the pressure will be excessive. Check the dash unit to see that it has held the reading. If it does not, the dash unit must be replaced. Test the air line for leaks by disconnecting at both ends and plugging the gasoline tank end and then sucking on the dash unit end. The vacuum should be sufficient to hold the tongue against the tube for a



K.S. 'TELEGAUGE' FUEL GAUGE.

minute. If it does not, the line leaks and should be replaced. Then connect up the air line, making certain that connections at both ends are tight, and drive the car to place the gauge in operation. Driving in such a manner as to cause the gasoline to splash in the tank will hasten the building up of the air supply in the tank unit cup. If the gauge does not register after a short period of driving and if the reading is not held after the car is stopped, the tank unit is defective and must be replaced.

SERVICING FUEL PUMPS

TESTING:—When fuel pump fails to operate satisfactorily, check pump for minor defects as directed on individual system pages before any attempt is made to disassemble pump. Manufacturers recommend that pump be given an operating test after being removed from engine to conclusively determine that pump is defective. Mount pump in a test stand or rigidly on the bench and attach rubber tubing to inlet and outlet openings. Immerse inlet tubing in a pail or jar of gasoline or kerosene and operate pump by manipulating pump lever. A.C. fuel pumps should fill the strainer bowl in 40 strokes of the lever and should raise fuel to a level 30 inches above the supply. The Stewart Warner fuel pumps should prime themselves in approximately 20 strokes of the pump lever. If this test demonstrates that pump is defective it will be necessary to disassemble pump to replace diaphragm or driving spring. Gasoline leaking through the vent hole in the pump body indicates that diaphragm is cracked or broken or that gasoline is leaking around the operating pull-rod where it passes through the diaphragm.

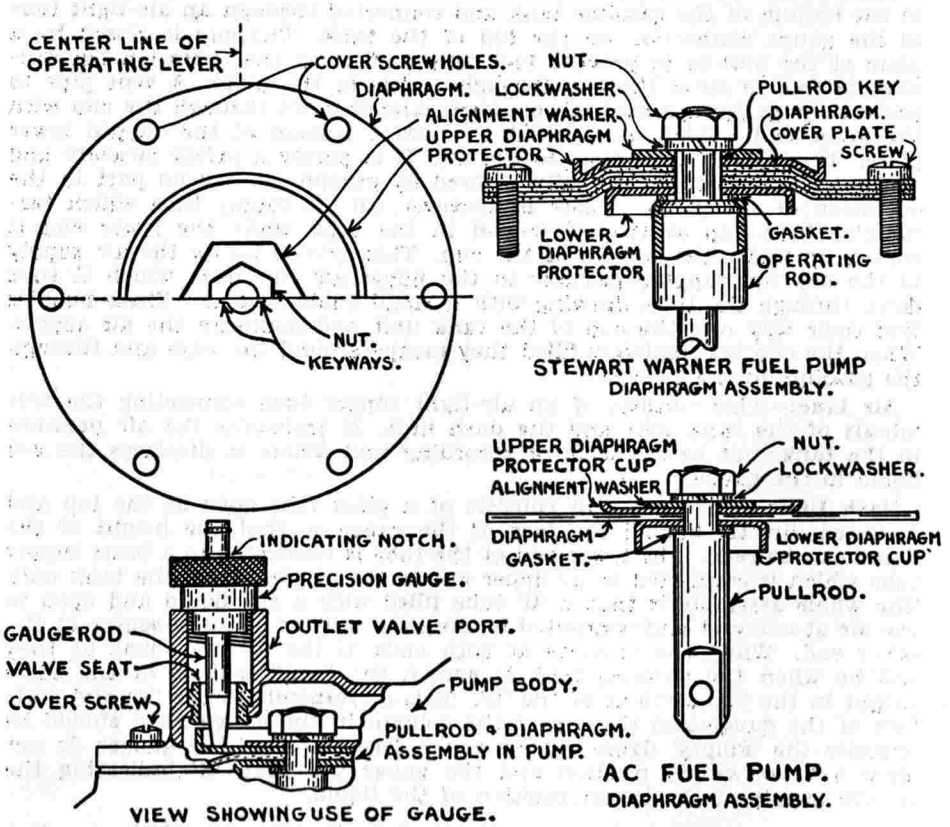
TO REPLACE DIAPHRAGM:—Special fixtures and gauges are necessary in replacing diaphragms on A.C. pumps. To replace diaphragm, mount pump body rigidly in vise or on a test stand, take off pump cover (first mark pump cover and pump body to insure correct reassembly), take off nut on end of pull-rod, remove lock washer, alignment washer, upper diaphragm protector cup and old diaphragm. To install new diaphragm, assemble pull-rod gasket and lower diaphragm protector cup (with cup portion pointing down) on pull-rod, taking care that gasket is seated against shoulder on pull-rod. Then place four layers of diaphragm material on pull-rod and carefully line up holes, using a special locating ring or several cover plate screws. Place upper diaphragm protector cup on pull-rod (with cup portion pointing up), place hexagonal alignment washer on diaphragm protector, and assemble lock washer and pull-rod nut. Use special wrench to hold the alignment washer from turning while the nut is being tightened and keep diaphragm holes lined up with the locating ring or several of the cover screws until the nut is tight. This is very important. Place pump cover in position and insert cover screws. Before cover screws are tightened, insert end of alignment wrench in hole in pump body and force pull-rod and diaphragm assembly to extreme upper position and hold in this position while cover screws are evenly tightened (tighten screws alternately to secure correct alignment of pump cover). Test diaphragm assembly by installing precision gauge in outlet valve port so that gauge rod rests on upper diaphragm protector cup. With the diaphragm correctly installed and in the extreme upper position the notch in the gauge rod should be visible at the top of the gauge.

Before installing pump, repeat operating test outlined above and after pump is installed on car examine priming action.

Combination Fuel and Vacuum Pumps. Diaphragms should be installed in this type pump with the pull-rod assembly out of the pump. Clamp the flatted end of the pull-rod in a vise, assemble pull-rod gasket and lower diaphragm protector (cupped side down) on pull-rod, place five layers of diaphragm material on pull-rod, lining up the tabs on the layers and turning the diaphragm so that the tabs are 7/16 inch clockwise from the center line of the pull-rod flatted end. Assemble upper diaphragm protector (cupped side up), alignment washer, lock washer and nut. Hold alignment washer with special wrench and securely tighten nut. Test diaphragm position to make certain that diaphragm layers have not been twisted or moved from position. This is very important. Assemble leather oil seal and cap on pull-rod boss, install driving spring, place pull-rod assembly in pump with diaphragm tab pointing toward center of mounting flange on pump body. Invert pump and engage flatted end of pull-rod in notch in operating link, turn pull-rod assembly one quarter turn until tab points toward projection on diaphragm flange. This will lock pull-rod and operating link. Then assemble pump cover as directed above.

These units cannot be tested on the bench due to the tension of the driving spring in the vacuum unit. They should be tested on the engine. See article on Type 'F' fuel pumps for special directions in mounting pump on engine.

Stewart Warner Pumps. Special tools and gauges are not necessary to replace diaphragms on these pumps. To install diaphragms, mount pump in bench vise, take off pump cover, nut, lock washer, alignment washer, diaphragm washer, and remove old diaphragm. See that spring retainer or lower diaphragm washer is properly installed with the cupped portion pointing down. Place four layers of diaphragm material (P-60637) in position on pull-rod, assemble upper diaphragm washer and alignment washer in place. Each of these parts has a keyway on the mounting hole. Line up keyways and compress driving spring so that the key on the pull-rod is engaged in these keyways. Hold the assembly in position and turn down nut and lock washer loosely. Hold the alignment washer from turning with a second wrench and tighten pull-rod nut securely. Be careful not to change relative position of diaphragm while this is being done. This is important. Then place pump cover in position, insert cover screws and turn screws down until about three threads on the end of each screw is engaged. Then flex diaphragm by pushing pump operating lever in toward pump as far as possible and hold it in this position while the cover screws are tightened evenly and alternately. This is important to secure the correct pump stroke. Test pump as directed above before installing in the car.



ATWATER KENT MOTOR CAR RADIO

MODEL 81

DESCRIPTION:—The radio set and battery box are combined in a single case mounted under the floor boards. The speaker is mounted under the cowl. The set can be used with the conventional roof type antenna or a special Atwater Kent plate type antenna mounted under the running board (for cars with grounded chicken wire in top and for open cars). A special remote control unit is mounted on the steering column and is connected to the set through a flexible armored cable. Control unit is illuminated by a standard G-3½, 6-8 volt lamp. A ten ampere capacity fuse is mounted underneath the control unit.

INSTALLATION:—Battery and Set Case. The set can be installed under the car floor in any place which will provide sufficient clearance for all moving parts. Do not locate set too near exhaust pipe. The clearance between the bottom of the set and the road should be at least as great as that at any other point on the car. Use the top of the set as a template to locate holes for carriage bolts (four 5/16 inch holes), drill holes, install carriage bolts from inside of car, using large washers under bolt heads. Place set in approximate position under car but do not install until all other connections have been made.

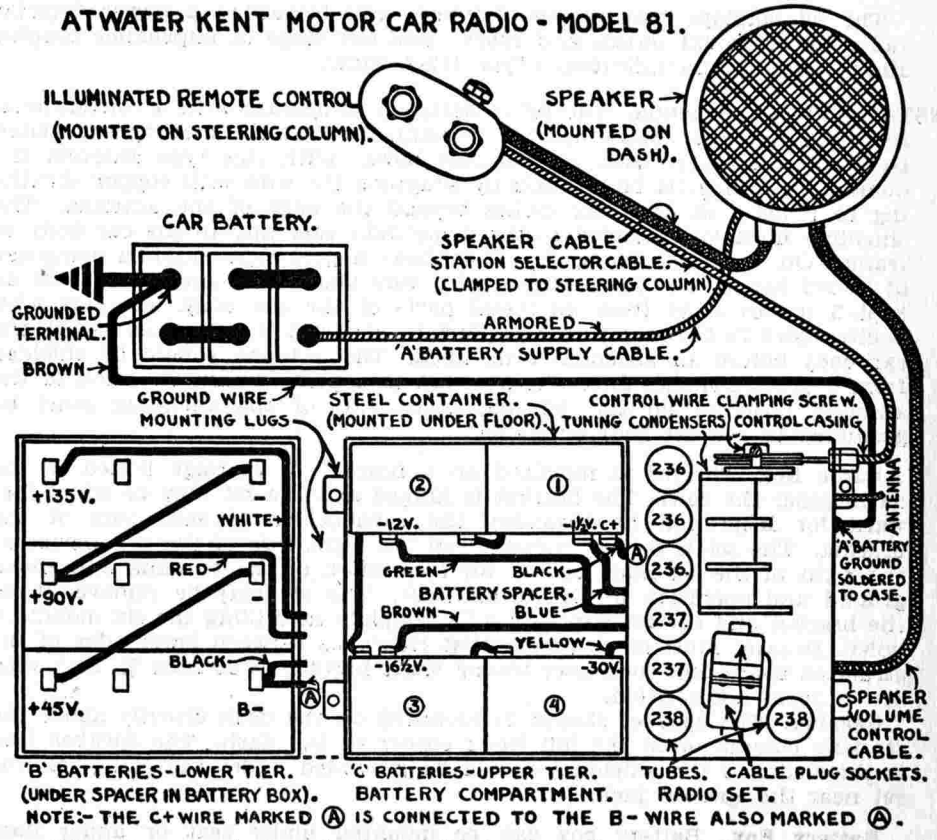
Speaker. The speaker can be mounted at any convenient place on the dash under the cowl in the front compartment. Speaker should be mounted with the plug sockets vertical. The flexible armored lead on the speaker should be connected to the ungrounded side of the storage battery (the ring terminal should be placed under the terminal bolt and bolt securely tightened). The two plugs on the large cable should be inserted in the vertical sockets under the set and the cable passed down through the floor boards through the steering column hole. If a separate hole is drilled for the cable a rubber grommet should be used to protect the cable.

Control Unit. Control unit should be mounted on right side of steering column at a convenient height. On small diameter columns leather strips can be used under mounting clamps but the pointed set screws must pass through the leather and contact the steering column. The control wire should be taken down through the floor boards at the steering column hole and then to the set. It must be protected from chafing against the clutch and brake pedals and must not be bent in less than a 3 inch radius. The cable on the control unit should be carried to the speaker and the five prong plug inserted in the socket on the speaker. The wire attached to the cable shield near the plug should be fastened to the ground binding post on the speaker.

Batteries. Three 45 volt 'B' batteries should be installed in lower tier of battery box and connected as indicated on diagram. Install spacer above 'B' batteries and place four 'C' batteries on spacer as shown in diagram.

Interference Suppressors. Suppressors are furnished for each high tension lead. They should be installed at each spark plug and the spark plug cable connected to the suppressor instead of directly to the plug terminal. A suppressor should also be used at the center terminal of the distributor cap and the coil high tension lead connected to it. A condenser is furnished for the generator circuit. This condenser should be connected to the relay terminal of the generator and the condenser case grounded (if condenser is mounted on the generator field frame a separate ground will not be necessary). An ignition filter is also provided for the primary circuit of the ignition coil. This filter should be connected in series with the coil (between the ignition switch and coil) and the filter case grounded. On cars using two coils a filter should be used in each coil circuit.

TUNING OF SET:—The control wire to the set should be cut to length with the set in its approximate location under the car and the control unit installed. It is recommended that a file be used to cut the control wire casing and that care be used not to bend or kink the control wire. The control wire casing is held in a brass chuck on the forward end of the set box. After the casing has been placed in the chuck and the jam nut tightened, the chuck and casing should be taped to secure a wtertight joint. The set should be grounded to the car battery by soldering the brown wire provided with the set to the clip on the set box and connecting the ring terminal on the other end of the wire to grounded terminal of the car battery (place the ring terminal under the battery terminal bolt and tighten bolt securely). The polarity of the battery need not be considered.



Then turn control unit dial to '0', turn condenser blades out against the stop (where they are held by a spring), wrap control wire around pulley and bend wire around screw, clamp wire under washer by tightening screw. See that control unit operates control wire freely, and over entire range of dial (to both ends) without backlash or lost motion. The surplus control wire can then be cut off. Solder the wire in the single shielded lead above the control chuck to the antenna lead and ground the shielding at a point furtherest from the set.

Operate the set by tuning in the strongest local station. Turn the volume control to the extreme counter-clockwise or minimum volume position. If the station is still audible, shift the brown 'C' battery lead to the -18 volt terminal. With the set still operating, lift the set box into position and tighten the wing nuts on the mounting bolts. Make certain that lock washers are used under the nuts. Use staples or metal clamps to fasten the control wire casing under the floor boards but do not bend the casing in small loops or sharp bends.

SPARTON AUTOMOBILE RADIO

MODEL AR-19

DESCRIPTION:—The Sparton Automobile Radio is a five tube set designed to be mounted under the cowl directly behind the instrument panel with the control unit (mounted on a bracket on the front of the set) extending out below the lower edge of the instrument board. The speaker is mounted separately on the dash under the cowl. The 'B' and 'C' batteries are mounted in a battery box under the seat or under the floor boards of the car.

The set employs three stages of tuned radio-frequency, a power detector (all using Type 224 screen grid tubes), and one stage of impedance coupled audio-frequency amplification (Type 112-A tube).

INSTALLATION:—Antenna. The set is designed to operate with a conventional roof type antenna. Manufacturer recommends that a screen type antenna be used on all cars with wooden roof bows. With this type antenna the dome light lead must be shielded by wrapping the wire with copper sheathing to a point at least six inches beyond the edge of the antenna. The shielding must be grounded to the dome light case and to the car body or frame. On cars with metal type roof bows a grid type antenna composed of 65-100 feet of No. 16 rubber covered wire should be used. This must be kept 3 inches away from all metal parts of the car body. On cars with poultry wire in the roof this must first be removed if it is grounded to the car body before an antenna is installed. The antenna should be shielded from a point 2 inches from the antenna to a point within one inch of the antenna terminal on the set and both ends of the shielding must be grounded to the car body or frame.

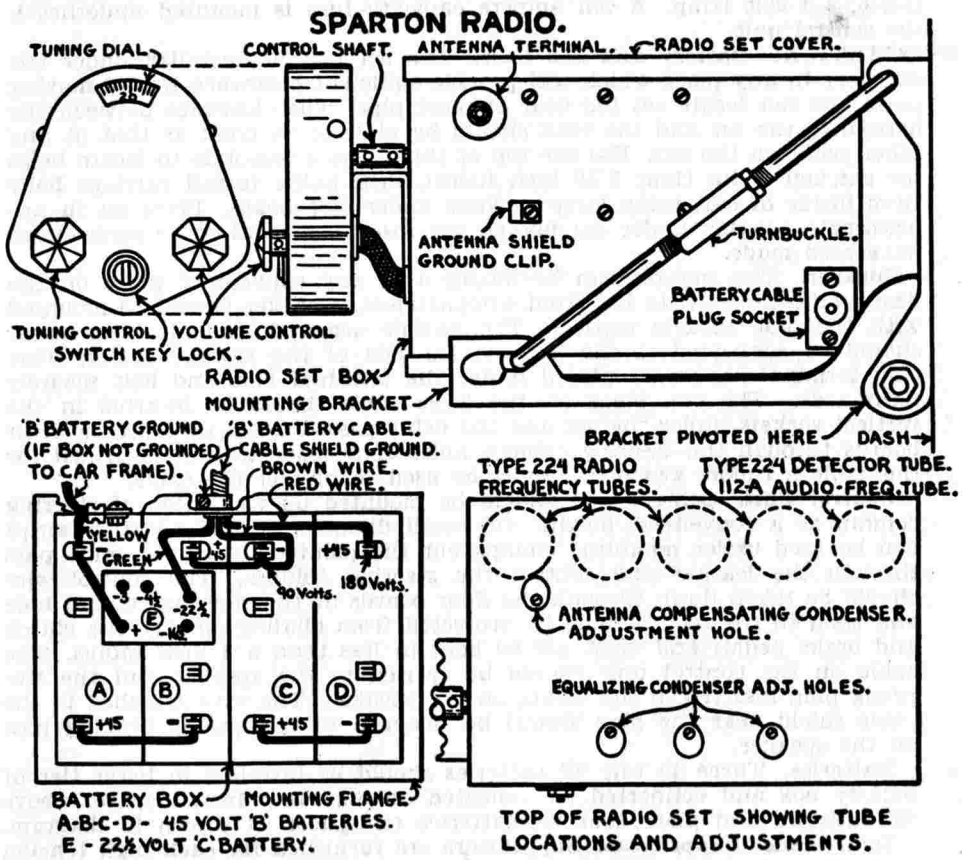
Radio Set. The set is mounted on a bracket or carriage bolted to the dash under the cowl. The bracket is hinged and the set may be tilted forward for inspection by loosening the turnbuckles at each side of the bracket. The set is usually mounted on the right side of the car (space at the right of the set must be left for connection of the antenna and shield ground and operation of the turnbuckle). The set may be removed from the bracket and the bracket used as a template in drilling the six mounting holes. Bracket must be so placed that clearance between lower edge of instrument board and condenser tuning shaft bushing is at least ⅜ inch with set in operating position.

Speaker. The speaker should be mounted on the dash directly above the steering column or in the left hand corner of the dash. The speaker lead is shielded and the shielding should be grounded under the clamp on the set near the speaker jack.

Battery Box. Battery box can be mounted under seat or under floor boards by cutting a hole 8¾ inches by 13⅛ inches in size which will allow box to slide through (box will be supported by flange under top). Battery cable from set should be run down through ¾ inch hole in floor boards near set and under car floor to battery box. If battery box is not grounded by touching some metal portion of the car, a separate ground wire should be run from the box to the car frame.

Set uses 4 standard 45 volt B batteries connected as shown on diagram. Install spacer over B batteries and install standard 5 terminal 22.5 volt C battery. Do not connect C-wire (green wire) until installation of set is complete. The five prong plug on the set end of the battery cable should be inserted in the socket on the right side of the set. The single wire (shielded by metallic sheathing) which emerges from the side of the plug should be connected to the discharge side of the ammeter (A battery lead). The other wire should be grounded as directly as possible. Both leads should be cut to fit and joints soldered (shielding on ammeter lead should be cut back one inch and taped to prevent grounds). The polarity of the car battery may be disregarded.

Suppressors. Ignition interference suppressors should be installed on each spark plug and spark plug cables ronnected to the suppressors instead of directly to the plugs. A suppressor should be installed in the center terminal of the distributor cap and the coil high tension lead connected to it.

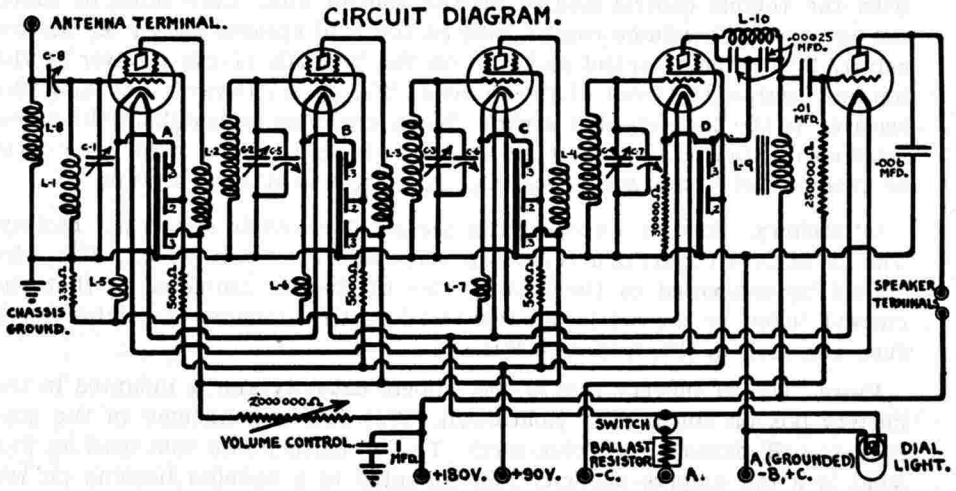


The by-pass condenser with two leads should be mounted on the coil high tension lead by means of the mounting clamp, one lead should be connected to the coil terminal marked 'Bat' (from ignition switch) and the other lead grounded to the engine block. The condenser leads must be kept as short as possible and should run parallel to the high tension cable (wrap both leads with tape). The second by-pass condenser should be mounted on the generator field frame and the lead connected to the generator terminal of the relay (condenser is grounded through mounting clamp). Manufacturer recommends that an additional by-pass condenser be connected from ammeter to ground if interference is caused by the dome light circuit.

TUNING OF SET:—With all connections properly made except 'C' battery negative lead (green wire), a milliameter should be connected in series with one speaker terminal. Switch key in control unit should be turned 'on' and volume control turned 'off'. Connect 'C' battery negative wire to terminal

on 'C' battery which will result in a current of 8-10 milliamperes through speaker. The 'C' voltage required will vary from 12 to 22.5 volts, depending upon grounded terminal of the car battery and the individual tubes installed in the set. This also depends on the condition of the 'B' batteries and should be checked occasionally during the operation of the set.

Then tune in a weak or distant station at a point near 80 on the dial, tilt set down (by loosening turnbuckles), insert screwdriver in forward opening in cover and adjust antenna compensating condenser until maximum volume is secured (turn screwdriver to right or left). Do not attempt adjustment unless set cover is in place. If necessary to adjust equalizing condensers a special wrench must be secured from the manufacturer.



Explanation of Wiring Diagram

C-1, C-2, C-3, C-4—Variable Condensers.
C-5, C-6, C-7—Equalizing Condensers.
C-8—Antenna Compensating Condenser.
A, B, C, D—These condensers are constructed in one block.
L-1, L-2, L-3, L-4—Tuning Coils.
L-5, L-6, L-7—Cathode Coils.
L-8—Antenna Inductance.
L-9—Impedance Coupling Coil.
10—Detector Plate Choke.

TROUBLE SHOOTING:—Tubes. Screen grid tubes are connected in series (first two radio-frequency stages in series with each other, third radio-frequency tube in series with detector) and failure of one tube will prevent the other tube from heating. Tubes should be replaced with standard tubes of the same type, properly inserted in sockets and grid caps installed tightly on ferrules on tubes. Whenever one tube is installed the heater voltage across it and across the other tube in series with it should be checked. A difference of more than .2 volts between the two tubes should not be allowed.

Oscillation. To correct oscillation or squealing, check rotor shaft to make certain that it is correctly grounded at each partition in set. See that contacts are clean and bearing on shaft. Do not put oil on shaft.

See that set is properly grounded. On cars with metal dash grounding of bracket to dash is usually sufficient. On cars with wooden dash, run an additional ground to the car frame. If set is operated while off mounting bracket for testing purposes, it must be grounded to the car frame.

Check tubes by trying each tube in detector socket. If this does not reveal trouble, shift screen grid lead in battery box (brown wire) to plus 67½ volts instead of plus 90 volts. If this does not decrease sensitivity of set at any one point too much, set can be operated with this connection. Otherwise equalizing condensers must be adjusted slightly (turn last condenser down slightly and first condenser up slightly) to decrease regeneration.

Interference. If interference continues with by-pass condensers and suppressors properly installed, remove shield ground on antenna at set, and ground aerial post with as short a lead as possible. Operate set. If noise continues, see that top and bottom of set are making good contact with sides of set box; if necessary bend top and bottom covers slightly at either side of dial shaft opening and on one side about 3 inches back from dial end.

Then ground antenna lead-in shield to set. If interference results it will be necessary to change the ground between the shield and the car body or change position of shield ground on the set. The speaker cable shield ground should also be checked in this manner to determine if interference is resulting from its location.

PHILCO-TRANSITONE RADIO

MODEL 3

DESCRIPTION:—This model Philco-Transitone Radio Set is of the seven tube type with three stages of radio-frequency amplification (Type 224 tubes), a detector-rectifier (Type 171-A), a detector amplifier (Type 201-A tube), and two stages of audio frequency amplification (Type 201-A tube in first stage and 171-A tube in second stage). The receiver is mounted in a case designed to be mounted on the dash under the cowl with the speaker also mounted on the dash separately. The control unit is designed to be mounted on the instrument panel or on the steering column (see next paragraph). Four 45 volt 'B' batteries are mounted in a battery box under the car floor or under the seat. No separate 'C' battery is necessary.

INSTALLATION & ADJUSTMENT:—Antenna. It is recommended that a copper screen antenna be used on all cars with wood top bows or on cars with poultry wire in the top if this wire is not bonded wherever the wires are twisted together. The screen should be trimmed back three inches from all metal parts of the car and around the dome light and one edge should be soldered. The antenna lead-in wire should be soldered to one corner of the screen. On cars with poultry wire tops where the poultry wire is bonded and free from all grounds, this may be used as an antenna and the lead-in soldered directly to it. On cars with metal top bows, it will be necessary to string a stranded, rubber covered wire back and forth between the top bows.

Battery Box. The battery box is designed to be mounted through a hole cut in the car floor so that the batteries are carried under the car. If this is not possible the batteries can be mounted under the car seat if proper care is taken to secure them so that they will not be subject to shaking or vibration. The shielded battery cable passes through a bushing on the side of the box. The blue wire in the cable is connected through the fuse to the positive (+) terminal of the battery. The green wire is connected to the negative (—) terminal of the battery. The four batteries are connected in series so that the voltage across the "B' battery wires is 180 volts.

Control Units. Control units are designed to be mounted through the instrument panel or on the steering column. A special housing and mounting bracket are used for steering column installation. For steering column mounting, the control unit is mounted on the back plate, the housing is placed over the unit and fastened by the hexagonal nuts on the volume control and flexible shaft bushings. The mounting bracket is held on the steering column by a strap which is provided with several holes for steering columns of different sizes. After the control unit has been mounted on the mounting bracket, the cables and flexible shaft should be fastened to the steering column.

After the control unit and receiver have been mounted in place the flexible tuning shaft must be coupled to the set. The free end of flexible shaft should be pushed through the bracket on the receiver so that the tip of the shaft is seated in the coupler. The two screws on the coupler and the set screw on the bracket should be tightened. A station of known frequency should then be tuned in very sharply on the receiver, the two set screws on the coupler which lock the shaft in place should be loosened, the tuning shaft turned until the dial corresponds with the station being received (dial figures are channel numbers and should correspond with the first two figures of the station frequency in kilocycles), the coupler set screws should be tightened, and the adjustment checked at several points.

On first sets the volume control was connected directly to the receiver. On later sets the volume control cable was connected to a four prong plug with the volume control located on the control unit. Care must be taken not to insert the volume control plug in the loud speaker socket on the receiver. The volume control socket is on the left side of the receiver at the top and nearest the front of the receiver. The socket toward the rear of the receiver is the loud speaker socket. When the plug is installed, the screw between the two sockets must be removed, the tab on the metal plug must be fastened with this screw bonding the plug and flexible housing.

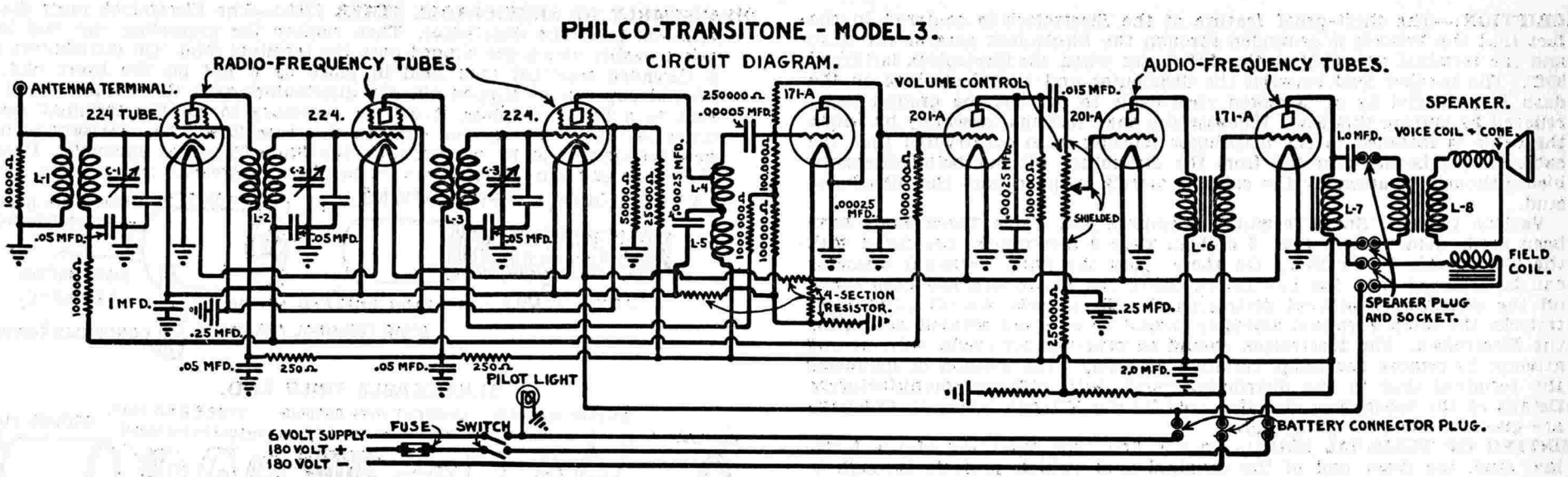
'A' Battery. Current for operating the set is taken from the car battery. The 'A' battery connection is a black wire from the receiver case. This wire should be connected to the battery side of the car ammeter so that the current taken by the set is not registered on the ammeter. On later sets a fuse was used in this lead (see Fuses).

Fuses. The 'B' battery fuse is one ampere capacity and is mounted in the battery box on the battery hold-down. This fuse is connected in the positive (+) 'B' battery lead (blue wire). The 'A' battery fuse (not used on first sets) is a ten ampere capacity fuse mounted in a bakelite housing on the 'A' battery lead. The fuse should be within ten inches of the 'A' battery and this end of the lead need not be shielded. The bakelite housing is made in two parts which are held together by two screws. The battery leads are soldered to the terminals on the fuse clips, the clips slipped over the ends of the fuse, the fuse placed in one bakelite housing piece with the leads in the recessed ends covered with split rubber tubing, the other bakelite housing piece assembled and the screws inserted. The shielding between the 'A' battery fuse and the receiver should be cut back about two inches from the fuse mounting.

Interference Suppressors. Spark plug resistors should be installed on each spark plug and in the center terminal of the distributor cap. In addition an interference condenser should be connected between the relay terminal on the generator and ground and between the battery side of the ignition coil and ground. If interference is experienced and other methods of suppression do not eliminate this, the ignition coil mounting location may be changed to the engine side of the dash, or (where lock coil types are used), the secondary connection to the distributor may be shielded from a point one inch from the coil to a point slightly beyond the dash. This shielding should consist of copper braid wound on a piece of loom placed over the high tension lead. The copper braid should be grounded.

PHILCO-TRANSITONE RADIO

MODEL 3



Circuit Diagram Explanation

L-7—Audio-frequency choke coil.
L-8—Output transformer.
C-1, 2, 3—Tuning condensers.
L-1, 2, 3, 4—Radio-frequency transformers.
L-5—Radio-frequency choke coil.
L-6—Audio-frequency transformer.

On first sets the 'A' battery lead was not shielded. On these sets, where interference is experienced, the 'A' battery lead should be shielded and the shielding grounded. It may also be desirable to connect the lead directly to the car battery instead of the ammeter. On later sets all cables were shielded. This shielding terminated in tabs or pigtails which must be grounded. The receiver is grounded through the mounting to the car frame.

TROUBLE SHOOTING:—Whenever interference is experienced see that suppresors are in place and properly installed, that all receiver leads are properly shielded and shielding grounded (above), and if necessary shift 'A' battery lead to car battery from ammeter. Do not shield the high tension leads from the distributor or between the ignition coil and distributor except as above. Ignition resistors or suppressors do not affect ignition performance but shielded high tension cables may cause ignition trouble. The antenna lead-in may be shielded in extreme cases by using shielded high tension cable for the lead-in.

The three radio-frequency tubes have the filaments connected in series. If any of these tubes burns out the filaments of the other tubes will not heat up.

TESTING:—A set analyser should be used for all receiver tests. Tube socket readings for use with the analyser are as follows:

Tube Position	Type	Voltages Filament	Plate	Screen	Cathode	Grid	Plate Milli-amperes
First R.F.	224	2	150	80	2		1.5
Second "	224	2	150	80	2		1.5
Third "	224	2	150	80	2		1.5
Det. Rect.	171-A	5					
Det. Amp.	201-A	5	45			-1.0	1.0
First A.F.	201-A	5	140			-2.5	3.0
Second "	171-A	5	142			-32	16.0

The compensating condensers are properly adjusted at the factory and should not require adjustment. They should only be adjusted by using a good oscillator set up for operation with the set. The oscillator should be set for a frequency between 1000 and 1200 kilocycles, the volume control of the set turned on full, the set tuned sharply to the signal and the oscillator reduced so that the signal is barely audible. A special fiber wrench should then be used to adjust the third, second, and first compensating condensers, respectively, for maximum signal strength. After the adjustment has been completed the receiver should be tuned to several stations to make certain that the stations are tuned in at the proper place on the dial.

ELECTROLOCK

INSTALLATION AND REMOVAL

DESCRIPTION:—The theft-proof feature of the Electrolock is centered in the fact that the breaker is grounded through the Electrolock case at the dash and the terminal assembly at the distributor when the Electrolock is turned 'Off'. The breaker lead between the distributor and the Electrolock on the dash is protected by an armored steel cable to prevent the ground being relieved by cutting this lead. Likewise the snap terminal assembly by which the cable is fastened to the distributor housing is so constructed that the cable cannot be disconnected from the distributor without being disassembled although in assembly the cable is merely snapped onto the distributor stud.

Various types of Snap Terminal assemblies and Cable Timer Ends have been used. Some of the Type 5 and all Type 9 Electrolocks are fitted with the 'Serviceable Timer End'. On these types the Snap Terminal assembly can be removed from the Electrolock (after the Electrolock has been taken off the distributor) without destroying the Electrolock. On all other Electrolocks the Snap Terminal assembly cannot be removed without mutilating the Electrolock. The Electrolock should be returned for credit without any attempt to remove the Snap Terminal assembly. The method of mounting the terminal stud in the distributor varies with different manufacturers. Details of the mountings manufactured by the Mitchell Specialty Company are given in the next paragraph.

MOUNTING OF TERMINAL STUD:—On the first type mounting of the terminal stud, the inner end of the terminal stud (which projects through to the inside of the distributor) was threaded and was held in place by a nut screwed on after the terminal stud had been passed through the hole in the distributor housing. The breaker lead was taken from the terminal stud, in some types, by anchoring the breaker arm spring under the terminal stud nut. On these types the nut was ordinarily soldered to the stud. In removing the Electrolock from the distributor, it is necessary to remove the solder (being careful not to draw the temper of the breaker arm spring) and then take off the nut. The Electrolock cable can then be withdrawn together with the Snap Terminal Assembly as a unit. On Electrolocks with a Serviceable Timer End the snap terminal can then be removed. On Type 5 Electrolocks, without the Serviceable Timer End, the entire Electrolock and Snap Terminal assembly must be returned for credit.

The second type of mounting has the inner end of the terminal stud riveted to a flange or plate which ordinarily serves as the breaker lead terminal or as the stationary contact mounting plate. On these mountings it may be necessary to cut the terminal stud in order to withdraw the cable and Snap Terminal assembly, although in some installations the distributor housing is slotted to permit the terminal stud to be lifted out after the flange or plate is released.

In some instances other types of Terminal Stud mountings may be found as these are provided by the distributor manufacturer except for car models listed below.

Distributor Parts

Type 5 Electrolock

Part No.	Used On
1761	Essex (1928)
2204	Essex, Late 1928
2232	Hudson (1928)
2232	Falcon Knight (1928)
2232	Stearns Knight 6-80 (28-29)
2232	Willys Knight 66-A (1928)
2232	Willys Knight 70-A (1928)
2232	Peerless 80 (1928)
2232	Velie 88 (1928)
2238	Chandler 75, 85 (1928-29)
2238	Hupmobile Cent. 6 (1928)
2238	Hupmobile Cent. 8 (1928)

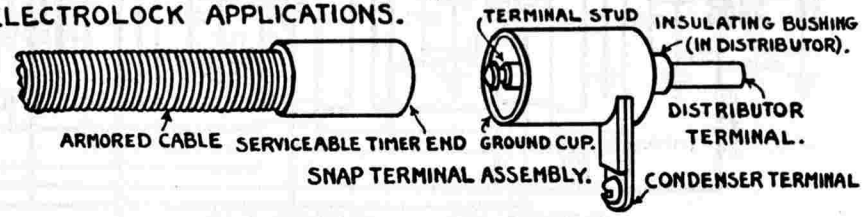
Type 9 Electrolock

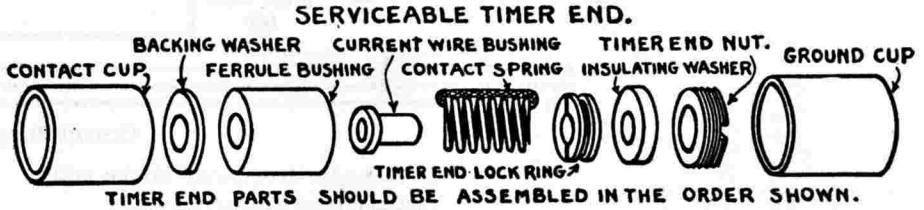
Part No.	Used On
2607	Essex (1929)
2607	Whippet 96-A, 98-A (1929)
2611	Hudson (1929)
2544	Willys Knight 70-B (1929)
2544	Hupmobile S (1929-31)
2544	Hupmobile L (1930-31)
2784	Essex SS (1930-31)
2859	Hudson 8 (1930-31)

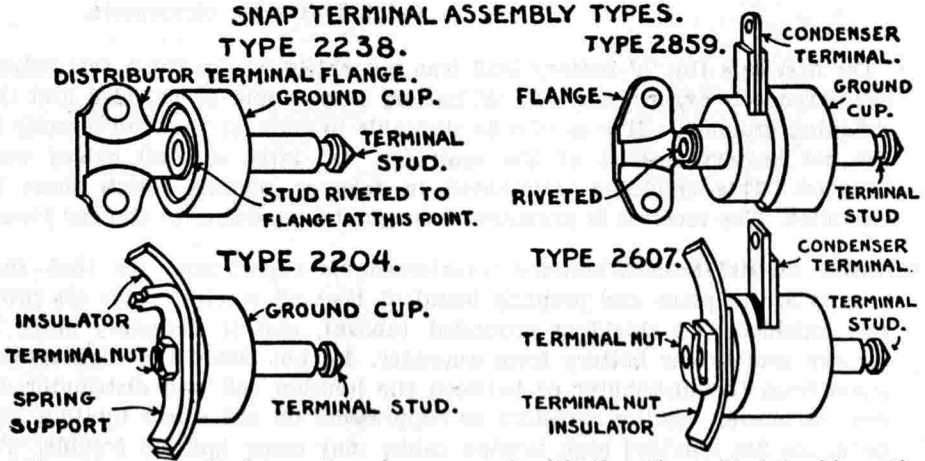
Type 14 Electrolock

3560	Auburn 8-98 (1931)

DISASSEMBLY OF SERVICEABLE TIMER END:—The Electrolock must first be removed from the distributor. Then remove the grounding cup and insulating washer which are slipped over the terminal stud. On distributors with a threaded terminal stud held in place by a nut on the inner end, the ground cup can be slipped off. On distributors with the terminal stud riveted to a flange or plate, it will be necessary to cut the terminal stud in order to slip off the ground cup. In this case it will be necessary to use a new terminal stud in reassembling the Snap Terminal assembly. Unscrew the timer end nut which is staked in place to prevent loosening in service.







The Snap Terminal can then be removed with the Timer End Locking Ring still in place on the end of the terminal stud. Free the Locking Ring from the terminal stud. The Locking Ring is made up of two segments held together by a spring and can ordinarily be used with a new terminal stud in reassembling the Electrolock.

The Timer End contact spring assembly is soldered to the current wire bushing. The current wire (or breaker lead within the cable) is crimped and soldered in the bushing. The current wire has sufficient slack so that it may be pulled out of the cable while the contact spring assembly is being examined. In replacing in service, it will be sufficient to solder the wire to the current wire bushing. The parts should be assembled in the order shown in the illustration. The Timer End nut must be staked in place tc prevent it loosening in service.

ELECTROLOCK

TYPES 15-S AND 15-SD

DESCRIPTION:—These types follow Electrolock principles in that the breaker and ignition coil are grounded with the switch turned 'Off' and the breaker lead is armored to prevent the ground being relieved by cutting the lead. The construction of the switch assembly is new and does not follow previous designs (see illustration).

These Electrolocks correspond to the previous 'B' type switches in that provision is made for the connection of accessories such as gasoline gauges (these should be connected to the coil feed terminal—see diagram) and in addition an extra terminal for Startix connection is provided. This terminal should be connected to the 'IGN' terminal on the Startix case.

The Type 15-SD Electrolock is designed for use with ignition systems using two coils, each controlled by a separate set of breaker contacts (see diagram on Auburn 12-160 using this system and Electrolock). Two breaker lead terminals are provided on the Electrolock switch assembly and these are connected to two insulated wires in the armored cable. These wires terminate in a special distributor terminal on the distributor housing from which the connection to each breaker arm is made.

OPERATION:—These switches are provided with two 'On' positions and a special terminal for Startix connection. The 'On' position with Startix operative (key turned to the right) is the normal running position. The second 'On' position (key turned to the left) closes the ignition circuit but does not complete Startix circuit so that Startix is inoperative. This switch position should be used in timing the engine when automatic cranking is not desired and can also be used to operate the car with the generator or Startix inoperative.

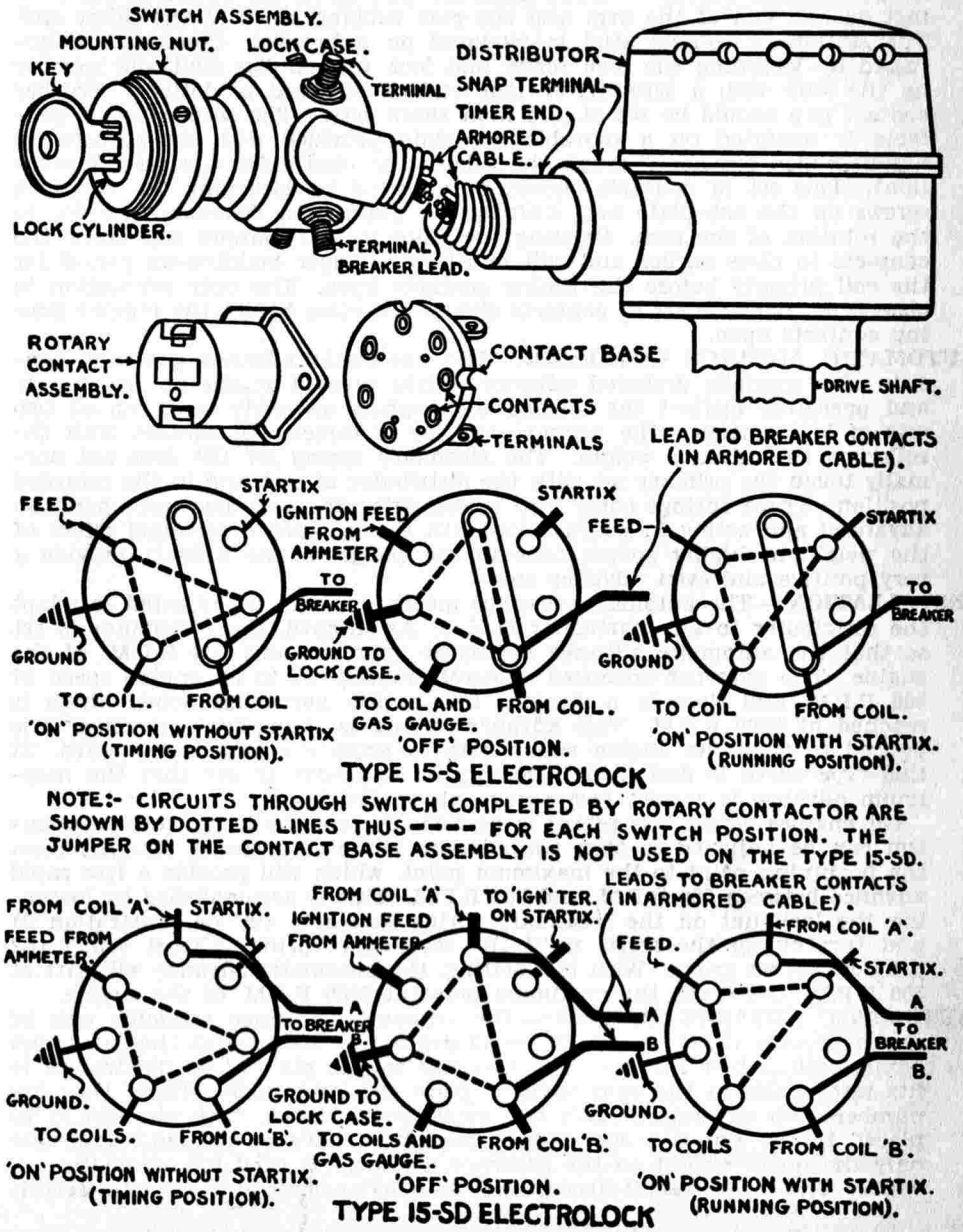
SERVICING:—Switch Assembly. To disassemble assembly for inspection and servicing, remove the lock from the mounting, disconnect all wires from terminals, turn back stakings and remove lock case cover. Take out all terminal screws and bushings, pull out contact base assembly and rotary contact for inspection. Replace all parts in reversed order and take care to securely stake lock case cover before reinstalling Electrolock.

Distributor Terminal and Current Wire Assembly. To disassemble Distributor Terminal for inspection and servicing, first remove lock case cover on switch assembly (see above) and open clips which hold end of current wire, then remove timer end and timer parts assembly from distributor housing, drill out distributor connection cup opposite timer end locking pin, drive out locking pin, turn back stakings and remove distributor terminal and current wire assembly through timer end. When reassembling the current wire should be soldered at the lock end, and both lock case cover and timer end should be staked securely to hold the assembly in place. On the Type 15-SD be sure to allow at least one coil of slack in each current wire at the timer end when wires are soldered at the lock end.

Yale Type Lock Cylinders. To remove these lock cylinders, turn key toward left hand running position and press a small pointed tool into the hole on the side of the lock case at the same time. When the tool enters the hole in the lock cylinder, the retaining pin can be driven out and the lock cylinder withdrawn. In replacing the lock cylinder the retaining pin should be driven in securely.

Briggs and Stratton Type Lock Cylinders. To remove these lock cylinders, turn key toward right hand running position (it will be necessary to disconnect Startix wire to prevent automatic cranking of engine), press a small pointed tool into hole in side of lock case and pry on lock cylinder spring retainer until lock cylinder is released and can be withdrawn.

TROUBLE SHOOTING:—Test circuits through Electrolock with lamp and test points to determine if switch is operating satisfactorily (see diagram for circuits). It should be remembered that 'Startix' terminal is connected to the feed terminal only with the switch in the right hand 'On' position. If these tests indicate that Electrolock is not operating correctly it should be disassembled and examined.



MALLORY IGNITION DISTRIBUTOR

DESCRIPTION:—Mallory Ignition Distributors incorporate two new features, a second set of 'coil loading' contacts and a new automatic advance governor. The breaker has two sets of contacts, of which only one set is used to time the distributor to the engine. The second set of contacts can be regulated to increase the length of time the primary circuit is closed between the successive firings of the spark plugs.

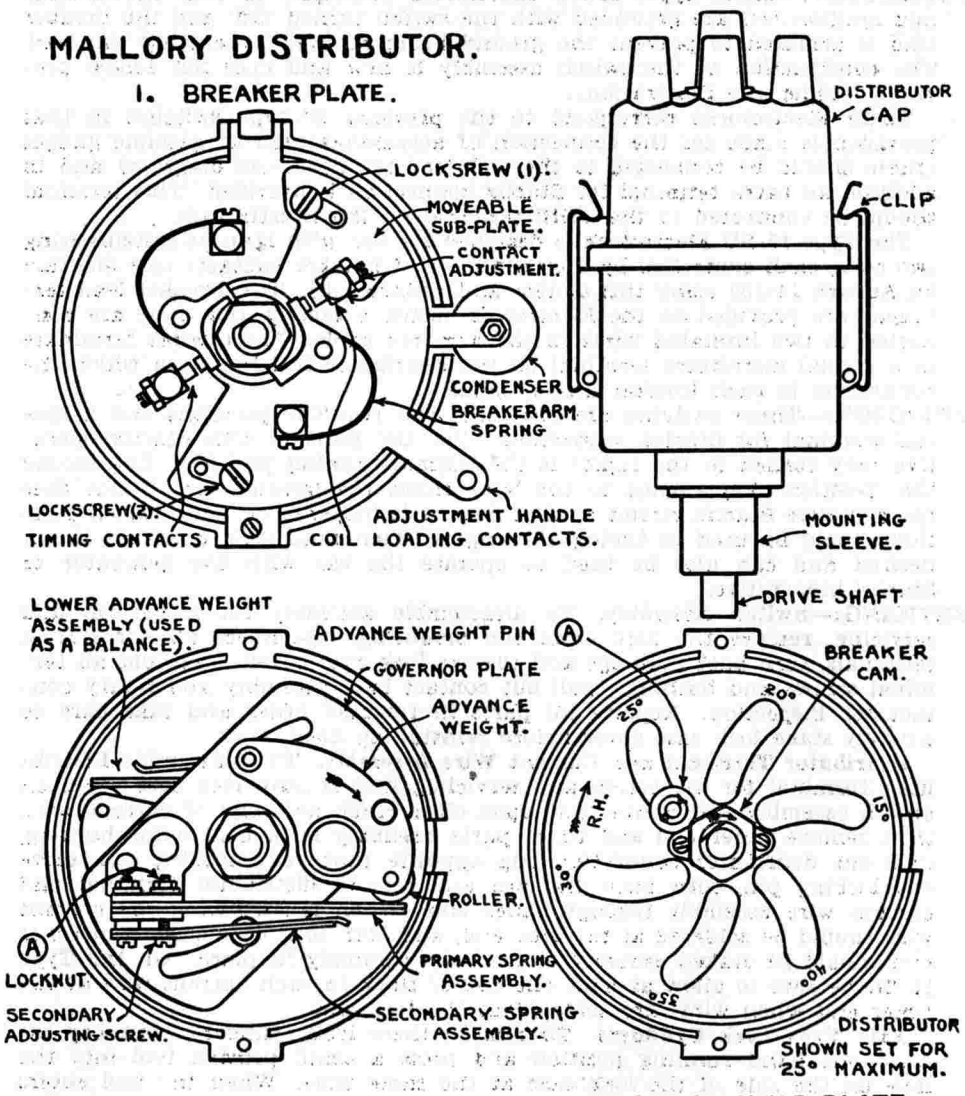
CONTACT ADJUSTMENT:—Breaker arms are pivoted in the center of the contact on one end of the arm and the cam rubbing block at the other end. The stationary contact stud is mounted on a bracket. Contacts are adjusted by loosening the lock screw and lock nut on the stud and turning up the stud with a screwdriver (the end of the stud is slotted). Breaker contact gap should be set at .015 inch (both sets). The second set of contacts is mounted on a movable sub-plate provided with an adjustment handle which extends through the side of the distributor cup (see illustration). This set of contacts should be adjusted by loosening the two lock screws on the sub-plate and shifting the plate in a direction opposite to the rotation of the cam. Shifting the plate in this manner will cause the contacts to close earlier and will result in a longer building-up period for the coil primary before the timing contacts open. The only precaution to observe is that this set of contacts should not close before the regular timing contacts open.

AUTOMATIC ADVANCE GOVERNOR:—The automatic advance governor consists of a specially designed advance weight pivoted on the governor plate and operating against the tension of a spring assembly made up of two sets of leaf springs. The primary set (A) is directly in contact with the roller on the advance weight. The secondary spring set (B) does not normally touch the primary set with the distributor at rest and in the retarded position. These springs come into action after the cam has been partially advanced and acting in conjunction with the lessened centrifugal effect of the weight at higher speeds (due to the design of the weight) provide a very positive and even advance curve.

INSTALLATION:—The automatic advance mechanism can be adjusted to adapt the distributor to any particular engine. As shipped, the distributor is set so that the automatic advance begins at approximately 500 R.P.M. of the engine. The governor advances relatively rapidly up to an engine speed of 800 R.P.M. and then in a straight line to the maximum point, which is reached at 2800 R.P.M. This advance setting is normally used when it is desired to time the engine rather late to provide considerable retard. If this type curve is desired, it will only be necessary to see that the maximum advance is correct (see paragraph on 'Settings').

On engines where less retard is desired, the automatic advance mechanism can be adjusted so that the advance curve is perfectly straight from the beginning point to the maximum point, which will provide a less rapid advance between 500 R.P.M. and 800 R.P.M. This is accomplished by loosening the lock nut on the secondary spring assembly ('A' on illustration 2) and turning up the screw until the secondary springs almost touch the primary spring group. With this setting, the automatic advance will sart at 500 R.P.M. and reach the maximum point at 3000 R.P.M. of the engine.

AUTOMATIC ADVANCE SETTING:—The automatic advance assembly can be set to provide 15, 20, 25, 30, 35, or 40 degrees of advance at the maximum point (2800 or 3000 R.P.M.). The governor weight pin ('A' on illustration 1) fits into a slot in the cam advance plate (illustration 3). These slots are numbered to correspond with the maximum advance. The pin should be placed in the slot corresponding to maximum advance desired. Note that only the upper weight on the governor assembly is used for automatic advance. The lower weight acts merely as a balance. The governor assembly can be turned over to reverse the direction of rotation so that the other weight is used for advance, but in any event the lower weight is used as a balance.



2. AUTOMATIC ADVANCE GOVERNOR.

3. CAM ADVANCE PLATE.

Special Advance Curves. The settings as outlined above will provide maximum advance of 15, 20, 25, 30, 35, 40 degrees at either 2800 R.P.M. or 3000 R.P.M., depending on the setting of the secondary spring assembly. If it is desired that the maximum point should be reached at a lower speed, the lock nut on the secondary spring adjusting screw can be loosened and the screw backed off slightly. Special spring assemblies are furnished (primary springs, secondary springs or both) to provide any desired advance curve.

MALLORY VACUUM SPARK CONTROL

DESCRIPTION:—The Mallory Vacuum Spark Control consists of a mechanical brake operated by the vacuum in the intake manifold of the engine which tends to retard the governor cam advance plate in its rotation and so counteract the effect of the automatic advance governor under certain conditions of engine operation.

The Vacuum Spark Control consists of a piston in a cylinder in the side of the distributor housing. This piston has on its inner end a brake shoe which bears against the edge of the governor cam advance plate and is kept in contact with the plate by a spring behind the piston. The outer end of the cylinder behind the piston forms the vacuum chamber and is connected to the intake manifold of the car engine by tubing (see diagram for sectional view of entire assembly).

OPERATION:—Whenever the vacuum in the manifold is high, as when the engine is idling or being operated under light load with the throttle closed, the vacuum behind the piston will allow the brake piston and brake shoe to move out (away from the governor cam advance plate) against the spring. The governor cam advance plate is then controlled solely by the centrifugal advance weights and the spark will occur at a point determined by the speed of the engine (the advance in degrees will of course depend upon the particular curve for which the distributor has been designed).

Whenever the engine is accelerated or is being operated under heavy load with the throttle open, the vacuum in the manifold will decrease sufficiently so that the spring will force the piston in toward the governor cam advance plate, engaging the brake shoe with the edge of the plate. This drag on the governor cam advance plate tends to counteract the advancing action of the centrifugal weights so the spark occurs later than would otherwise be the case. At extremely high speeds when the vacuum in the manifold is low, the centrifugal force of the advance weights will be sufficient to overcome the effect of the brake so that no retarding of the spark occurs.

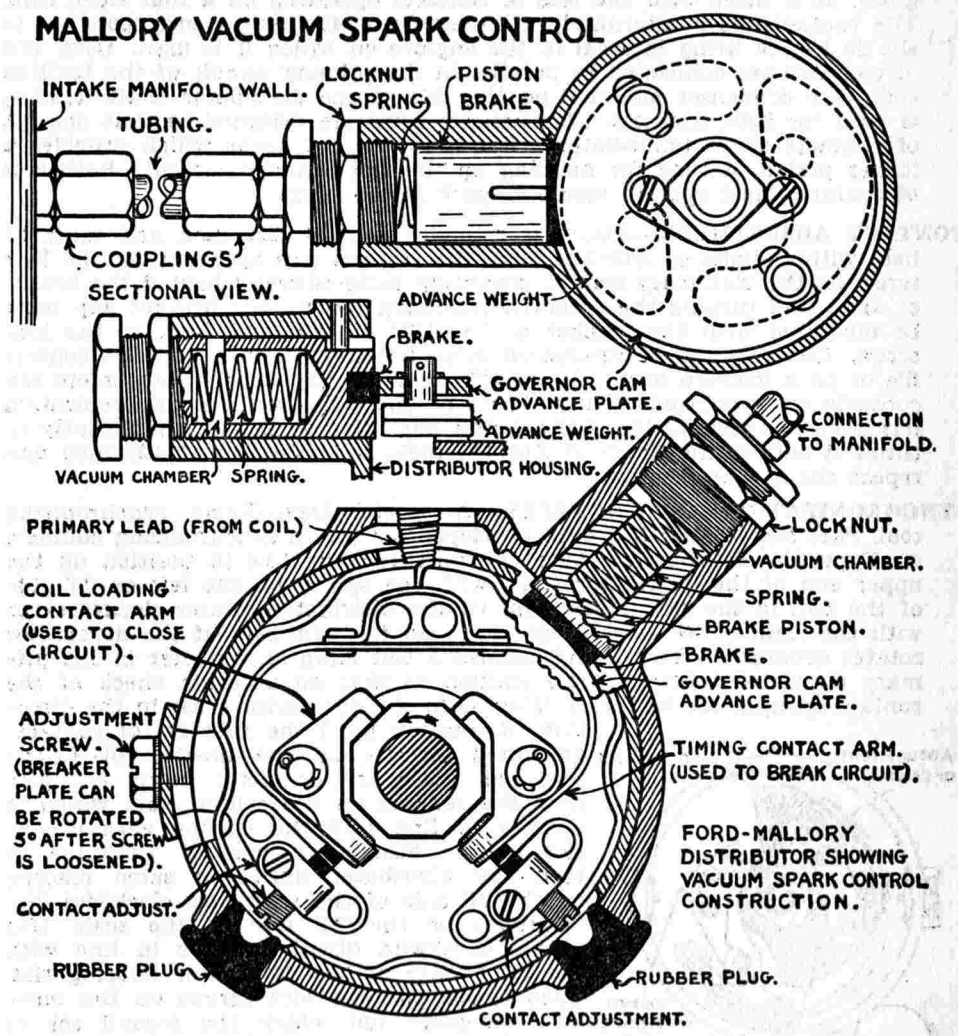
The Vacuum Spark Control has the effect of providing two distinct advance curves for the distributor, a relatively rapid advance for engine operation at light loads, and a slower advance for operation under heavy loads. It also provides a retard when the engine is suddenly accelerated, preventing spark knock. In operation the intake manifold vacuum will be high enough to keep the brake disengaged most of the time. With standard setting the brake begins to engage when the manifold vacuum falls to 10 inches (mercury column) and the full force of the brake is only applied when there is no vacuum in the manifold, as when the engine is operated with wide open throttle or under heavy load at low speeds.

ADJUSTMENT:—The spring tension is adjustable by loosening the lock nut on the end of the cylinder and changing the position of the adjusting nut. If the engine knocks on acceleration or under heavy load with the distributor set to give the proper advance at high speeds (the Mallory Distributor is adjustable for maximum advance—see previous page), the lock nut should be loosened and the adjusting nut screwed in. This will increase the spring spring tension and provide more retard for sudden acceleration and heavy load operation.

FORD-MALLORY DISTRIBUTOR

DESCRIPTION:—The Mallory Distributor used on the Ford V-8 is equipped with the Vacuum Spark Control described above. Breaker plate design is either as shown on the diagram on this page or is similar to the design on the previous page except that the movable sub-plate is not used and the coil loading contacts are mounted directly on the breaker plate so that their position can not be changed.

OPERATION:—The distributor follows the Mallory principle of operation in that one set of contacts is used to close the ignition primary circuit (coil loading contacts) and the other set of contacts is used to break the primary circuit, or to time the spark (timing contacts). The timing contacts are the left hand set (facing the breaker plate—right hand set from the front of the car). Since both sets are mounted rigidly on the breaker plate, the only adjustment is on the breaker contact gap. It is important that the gap be kept the same on both sets of contacts. For details of adjustment and gap limits, see the car data page.



FORD-MALLORY DISTRIBUTOR SHOWING VACUUM SPARK CONTROL CONSTRUCTION.

DISTRIBUTORS

SYNCHRONIZATION OF CONTACTS

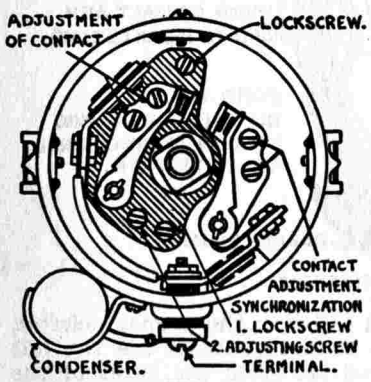
DELCO-REMY

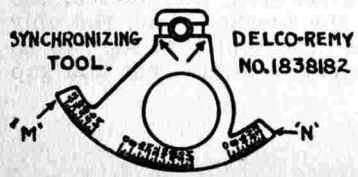
TYPES 660 AND 662

DESCRIPTION:—This type distributor is designed for use on eight cylinder engines. It is fitted with two sets of contacts operating on a four sided cam. The contacts open alternately at intervals of 45 degrees corresponding to the 90 degree firing interval of the engines on which it is used. Both sets of contacts are connected in parallel in the primary circuit of the ignition coil. One condenser mounted on the side of the distributor shaft housing is used for both contacts. The breaker arms are designed so that one set of contacts closes immediately after the other set opens which provides a longer period of time for building up the coil primary current. Both sets of contacts must open to secure a spark at the plugs.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch. Set contact gap by loosening the lock screw on the stationary contact mounting plate (directly behind the breaker arm) and turning the eccentric adjusting screw. The breaker gap must be measured with the breaker on the lobe of the cam. Tighten the lock screw. Contacts can be resurfaced when necessary with a fine flat contact file or on a medium hard oilstone. The contact gap must be set before the contacts are synchronized and should be checked after the synchronization has been completed. If synchronizing has affected the gap sufficiently to throw it outside the limits of .018-.024 inch, reset the gap at .022 inch and repeat the synchronization.

SYNCHRONIZATION OF CONTACTS:—A special Delco-Remy synchronizing tool, Part No. 1838182, has been developed for use in synchronizing contacts on Type 660 distributors. Place the synchronizing tool in position on the upper end of the distributor shaft with the spring on the left or 'M' side of the tool in the slot in the cam (if the distributor rotates clockwise) or with the right or 'N' side of the spring in the cam slot (if the distributor rotates counter-clockwise) and connect a test lamp or ammeter in the primary circuit and turn on the ignition so that an accurate check of the contact opening can be made. Then turn the distributor shaft in the direction of rotation until the first set of contacts (mounted directly on the breaker plate—the so-called stationary contacts) begin to open. Note the reading on the center scale which is directly in line with the leading edge of the slot in the distributor housing. Continue to turn the distributor until the same reading on the 'N' side of the scale (for clockwise distributors) or the 'M' side of the scale (for counter-clockwise distributors) is in line with the same edge of the distributor housing slot. Then loosen the two lock screws on the movable sub-plate (on which the second set of contacts are mounted) and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check synchronization by turning the distributor shaft through a complete revolution and again noting scale readings as contacts open. The variation must not be greater than 2 tool graduations which corresponds to 2 degrees of crankshaft rotation. The contact gap must be checked after synchronizing contacts. If outside limits of .018-.024 inch, reset at .022 inch and repeat synchronization.





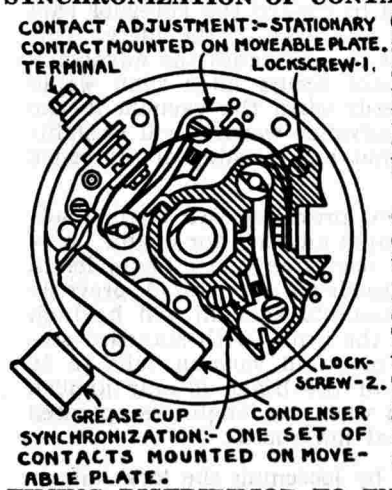
NORTH EAST

PACKARD AND CUNNINGHAM TYPES

DESCRIPTION:—These distributors are designed for eight cylinder engines and have two sets of contacts operating on an eight lobe cam. Contacts must be synchronized so as to open at the same instant in order to distribute the ignition load equally. If one set of contacts opens early, it will have no effect on the timing, which will be determined by the second set of contacts, but this second set will carry all the ignition load and will consequently wear more rapidly than would be the case if the contacts were properly synchronized. Contacts should be synchronized whenever the contacts are resurfaced and synchronization should be checked whenever the ignition timing is checked or set.

CONTACT ADJUSTMENT:—Contact gap should be set at .020 inch. Set contact gap by loosening the lock nut on the stationary contact mounting stud and turning up the stud until the gap is .020 inch with breaker arm rubbing block on lobe of cam. On the new type distributor (new Packard equipment) the stationary contact is carried on a moveable sub-plate. The lock screw on this plate should be loosened and the plate shifted by inserting the point of a screwdriver in the slot in the end of the plate and prying sideways on the screwdriver. Tighten the lock screw after making the adjustment.

SYNCHRONIZATION OF CONTACTS:—First Type. Distributors of this type were constructed with both breaker arms and contact assemblies mounted on a plate which was constructed with .020 inch clearance in the distributor cup. To synchronize contacts, loosen the lock screws on the breaker plate and shift the entire plate within the distributor cup until both contacts open simultaneously.



Second Type. Distributors of this type were constructed with one set of contacts mounted on a movable sub-plate. To synchronize contacts, loosen the two lock screws on the sub-plate, insert the point of a screwdriver in the slot in the plate and pry the plate to one side. Two small pins in the base-plate are designed to be used as fulcrums for the screwdriver. Tighten the lock screws after making the adjustment. The synchronization can be checked as part of the timing operation (see next paragraph.

TIMING DISTRIBUTOR TO ENGINE:—The synchronization can be accurately and easily checked while the distributor is being timed to the engine by using one set of contacts at a time. First block open the second set of contacts (mounted on the movable sub-plate) with a piece of cardboard or fiber insulator and proceed with the timing operation, using a test lamp to check the contact opening. Then change the insulator to the first set of contacts and repeat the timing operation except that the distributor advance plate clamping screw should be loosened and the plate shifted until the second set of contacts begin ot open. Check the contact gap after synchronization has been completed.

NORTH EAST LAMP CONTROL GENERATOR

MODEL LAB, TYPE 6620 AND 6564-A, CHECKER CAB AND MACK EQUIPMENT

DESCRIPTION:—This type generator, although it resembles the ordinary generator in construction (except that there are two terminals 'L' and 'B' on the field frame), operates differently than the regular third brush shunt field control types. The regular shunt field connected between the third brush and the grounded main brush through a field fuse mounted on the end plate is wound on one field pole. The other pole carries a divided series field ('A' and 'B' on the diagram). Both sections of this field are inoperative at speeds below the relay cut-in point when the lamps are turned off. When the lamps are turned on, the lighting current from the battery goes through both sections of the series field, which strengthens the magnetic field and causes the generator to cut in at a lower speed. The 'A' section of the series field continues to strengthen the magnetic field as long as the lights are turned on and is inoperative at all speeds when the lights are turned off. The 'B' section of the series field acts to strengthen the magnetic field when the lights are turned on until the relay cut-out contacts close and the generator takes care of the lamp load when it opposes or bucks the shunt field. This 'B' section also bucks the shunt field at all speeds above the cut-in point with the lights turned off. This tends to hold the charging rate down with the lights turned off and automatically increases the generator output when the lights are being used.

ADJUSTMENT:—Generator output can be adjusted in the usual manner by shifting the third brush. The third brush adjusting screw is located on the commutator end plate. Turn the adjustment screw to the right or in a clockwise direction to increase the charging rate and in the opposite direction to decrease the charging rate.

PERFORMANCE:—With standard car setting, the generator performance is as follows:

Generator Data—Type 6620

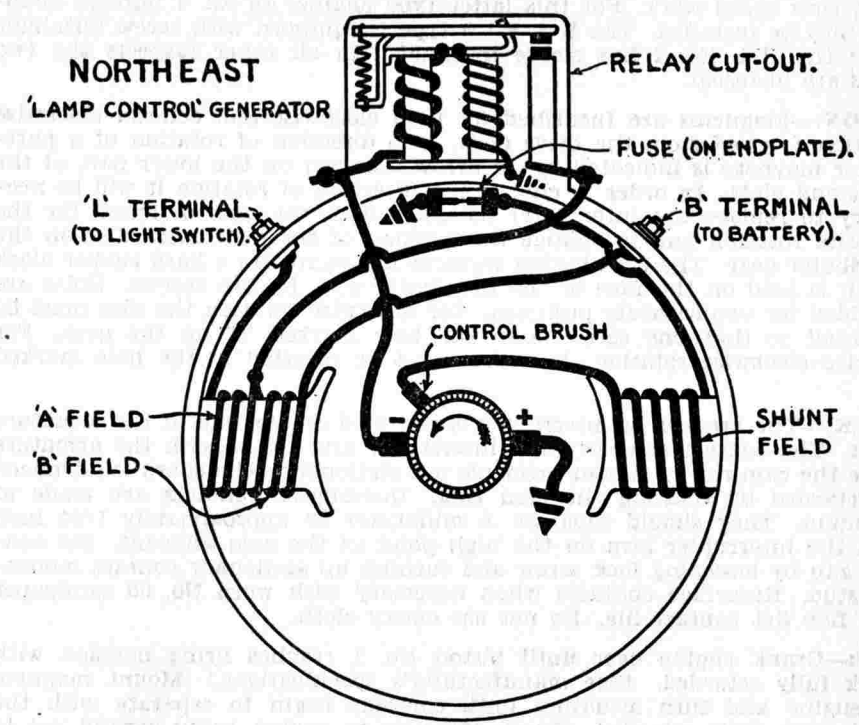
Load	Amperes	Volts	R.P.M.
Lamps off	9	8.0	1620
Lamps on	13.5	8.0	1600

Type 6564-A

Lamps off	7.7	8.0	1930
Lamps on	13.0	8.0	1900

RELAY CUTOUT:—**Type 20220.** Relay is mounted on the generator field frame. One terminal is connected to the negative main brush and the other relay terminal is connected to the series field lead. Note that the relay is not connected to the battery as is the usual practice. The battery is connected to the 'B' terminal on the field frame. Relay contacts close when the generator voltage reaches 6.75 volts and open with a discharge current of 1-2 amperes when the generator voltage drops to 5.75-6.0 volts. Relay contact gap is .020-.025 inch. Air gap is .015 inch with contacts closed.

FUSES:—The shunt field is grounded through a 10 ampere fuse mounted in a plug on the commutator end plate. No other size fuse should be used for replacement.



AMERICAN BOSCH MAGNETO

TYPES U-1, ED. 1; U-2, ED. 1; U-2, ED. 2; U-4, ED. 1; U-4, ED. 2

DESCRIPTION:—This magneto is of the high tension, rotating armature type and has been developed for high speed, heavy duty engines and also for heavy duty, slow speed work. For this latter type engine, an Ed. 4 impulse coupling may be installed. The U-4, Ed. 1 type is equipped with screw terminals while the U-4, Ed. 2 has sleeve terminals. In all other respects the two types are identical.

ROTATION:—Magnetos are furnished for both clockwise and counter-clockwise rotation (viewed from the drive end). The direction of rotation of a particular magneto is indicated by an arrow stamped on the lower part of the shaft end plate. In order to change the direction of rotation it will be necessary to replace the interrupter assembly with the unit designed for the opposite rotation and to change the position of the distributor disc on the distributor gear. The distributing segment is mounted in a hard rubber block which is held on the face of the distributor gear by two screws. Holes are provided for two separate positions. For clockwise rotation the disc must be mounted so that one screw is in the hole marked 'C' on the gear. For counter-clockwise rotation the screw must be inserted in the hole marked 'A'.

BREAKER:—The breaker or interrupter is mounted on the end of the armature shaft. The contact assembly and interrupter arm rotate with the armature while the cam ring and cam segments are stationary. The spark is advanced or retarded by rotating the cam ring. Interrupter contacts are made of platinum. They should separate .4 millimeter or approximately 1/64 inch with the interrupter arm on the high point of the cam segment. Set contact gap by loosening lock screw and turning up stationary contact mounting stud. Resurface contacts when necessary with worn No. 00 sandpaper or a fine flat contact file. Do not use emery cloth.

TIMING:—Crank engine over until piston No. 1 reaches firing position with spark fully retarded. (See manufacturer's specifications.) Mount magneto on engine and turn armature until contacts begin to separate with the spark lever fully retarded. Couple magneto to engine, being careful not to change position of crankshaft or magneto shaft.

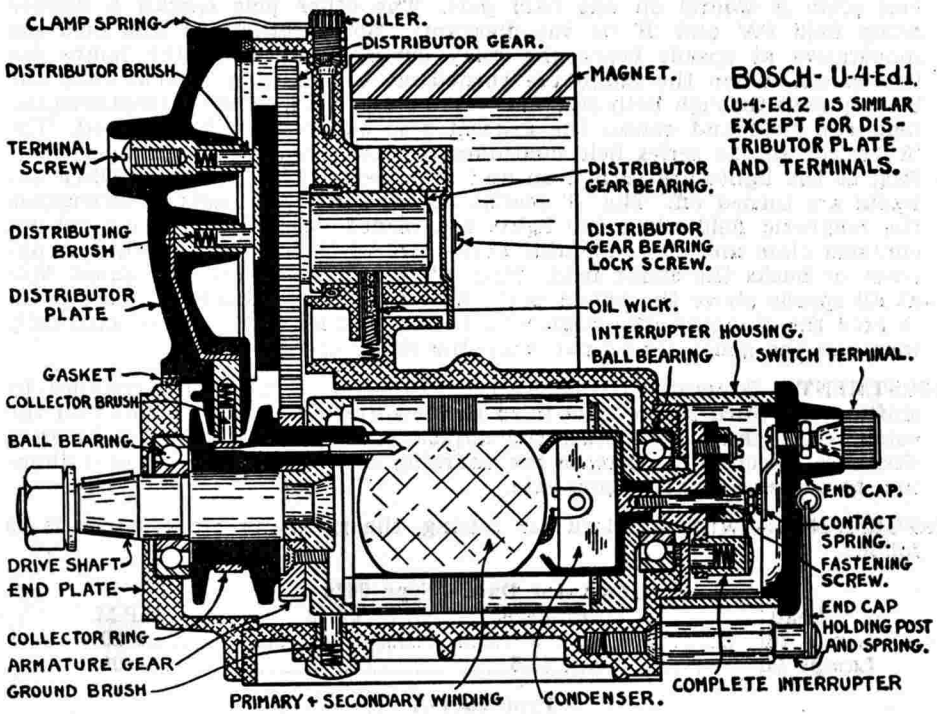
The magneto is fitted with a spark advance range of 25-35 degrees. It can be used with fixed ignition if desired. The distributor gear and armature gear are marked and must be correctly assembled to insure correct position of the distributor segment when the contacts open. One tooth of the armature gear is beveled. This should be meshed with the distributor gear tooth marked by a punch mark.

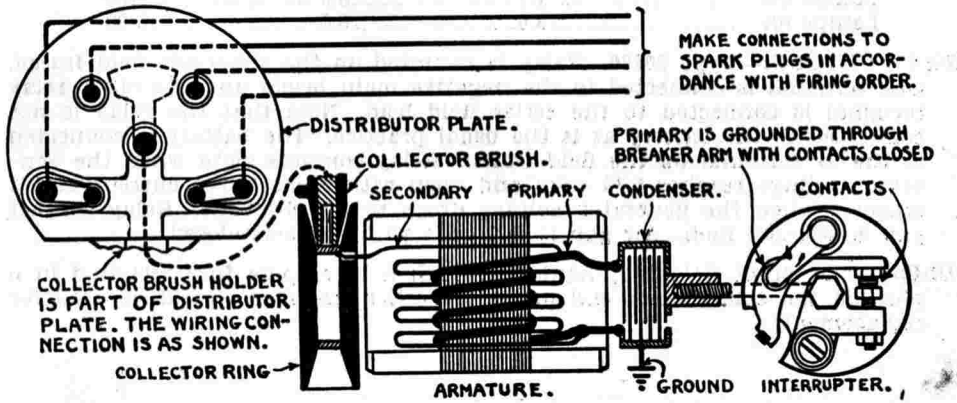
OILING:—The armature shaft is carried on ball bearings which are packed in grease and require no oil. The distributor gear shaft is carried on a plain bushing and is fitted with an oil hole at the top of the magneto. Put 2 or 3 drops of light machine oil in this oiler every 500 miles of operation.

SPARK PLUGS:—Spark plug gaps should be correctly set. This will depend on the type of engine used and in general should be .020-.025 inch. A safety spark gap consisting of a pointed screw extending through the shaft end plate to within a short distance of the collector ring is provided. This will protect the windings if the plug gaps are too wide or if cables become disconnected. The current should not be allowed to jump across the safety gap for any length of time and the ignition system should be checked whenever this occurs.

SERVICING:—The magneto is very simple in design and can be disassembled without difficulty. Disassemble in the following order: (1) Remove ground brush from under plug in base plate. (2) Swing spring on holding post to one side, remove end cap, remove interrupter housing. Then remove interrupter assembly using special Tool No. 339 to first take out interrupter fastening screw. (3) Press the holding screws to one side and remove distributor plate. Be careful not to damage collector brush which is carried on the lower end of the plate. (4) Carefully pull the distributor gear and armature assembly out together.

In reassembling the magneto be careful to properly mesh the gears (see Timing). Make certain that the oil wick does not interfere with the distributor gear shaft. If the gears are replaced it will be necessary to see that they are properly meshed. The gear mesh is adjustable by turning the distributor gear bushing slightly. This bushing is slightly eccentric and turning it will raise or lower the distributor gear. It is held in place by the distributor gear bearing lock plate which engages in the slot in the end of the bearing. The lock plate is slotted for two mounting screws to retain the bearing position.





STARTER CONTROLS

STARTERATOR USED ON CHEVROLET MASTER MODEL, 1933

DESCRIPTION:—The Starterator consists of a mechanism by which the accelerator pedal is connected to the starter switch operating linkage (with the engine stopped) so that pressing down on the accelerator pedal starts the engine. It is entirely automatic in operation and is engaged by a spring whenever the engine stops and the accelerator is released. After the engine has been started, the linkage is disengaged by the vacuum of the intake manifold and is held out of engagement as long as the engine is running.

OPERATION:—The starter control fork, which is pivoted on the end of the cross shaft, is operated by a rod connected to the vacuum unit mounted on the right hand end of the cross shaft support bracket. With the engine stopped, when there is no vacuum in intake manifold, the vacuum unit diaphragm will be pushed to the left by the spring in the vacuum unit. The connecting rod will force the control fork to the left so that it engages the slot in the accelerator pedal linkage. When the accelerator pedal is pressed (after the ignition has been turned on), the rotation of the cross shaft caused by the movement of the control fork will depress the starter switch mounted on the starter field frame (through the switch linkage), closing the switch and allowing the starter to crank the engine. As soon as the engine begins to fire, the vacuum in the intake manifold will draw the vacuum unit diaphragm to the right, disengaging the control fork from the accelerator linkage. This allows the starter switch return spring to open the switch and the starter Bendix pinion is automatically disengaged from the flywheel. As long as the engine is running the control fork will be held out of engagement by the vacuum unit so that the accelerator pedal controls the carburetor throttle in the usual manner. Whenever the engine is stopped or stalls, the control is automatically engaged.

ADJUSTMENT:—The Starterator will not require attention in service. However if new parts are installed or Starterator does not operate satisfactorily the following points should be checked and the adjustments correctly made:

1. Clearance between Control Fork and Floor Boards. Clearance between control fork and floor board should be ⅛ inch. To adjust, take up floor board and install special gauge in toe board anchor nut holes. Loosen check nut and turn adjusting screw on starter link arm at vacuum unit end of Starterator until control fork just touches gauge. Tighten check nut. This will give the required ⅛ inch clearance.

2. Control Fork at right angles to Cross Shaft. If the control fork is not at right angles to cross shaft, loosen check nut on left hand side of control fork and turn adjusting screw until angle between control fork and adjusting shaft is exactly 90°. Tighten check nut.

3. Clearance between face of Control Fork and Accelerator Rod. Clearance between the face of the starter control fork and the accelerator rod must be ⅛ inch. To adjust, disassemble the accelerator rod from the accelerator bell crank on the side of the engine, loosen the lock nut on the yoke end of the accelerator rod and adjust the length of the rod so clearance between rod and face of control yoke is ⅛ inch when accelerator rod is connected to bell crank with bell crank in idle position. Tighten lock nut on accelerator rod at yoke to hold adjustment.

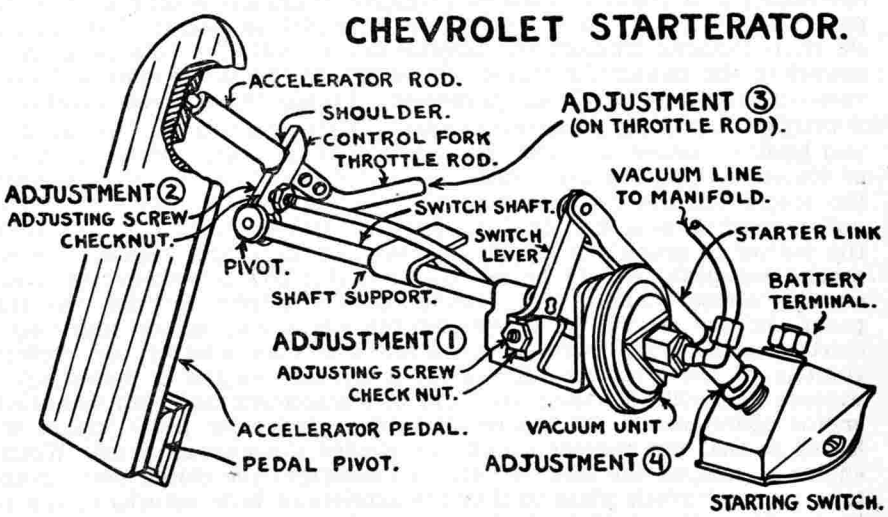
4. Clearance between Starter Link and Switch. Clearance between the end of the starter link and the starter switch must be 5/16 inch. If this distance is greater than 5//16 inch, a special adjusting spring should be snapped in place below the link.

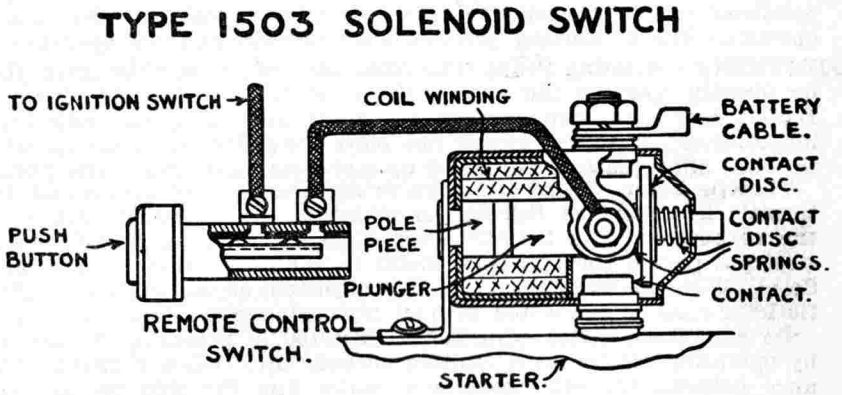
MODEL 1503 (PONTIAC 601, 1933)

DESCRIPTION:—This model is a magnetic switch mounted on the starter field frame. It is used in connection with a Bendix drive and does not include the pinion shifting mechanism of the previous models. It is operated by a 'remote control switch' or push-button starting switch connected to the ignition switch so that the starter may only be operated with the ignition turned on.

OPERATION:—The operation of the switch is the same as the models used on the Buick models (above) except that the pinion shifting mechanism is not used.

ADJUSTMENT:—This model requires no adjustment.





STARTER CONTROLS

MODEL 1550 SELECTOR (DE SOTO AND CHRYSLER, 1933)

DESCRIPTION:—This Selector consists of a selective clutch by means of which the accelerator pedal is connected alternately to the starting pedel linkage (with the engine stopped) or to the carburetor throttle linkage (with the engine running. The operation is entirely automatic and employs a vacuum unit operated by the intake manifold vacuum. The unit is mounted on the engine side of the dash directly above the starter so that there is 1/16-⅛ inch clearance between the starting pedal on the unit and the pinion shift lever roller on the starter. The vacuum control unit is mounted on one end of the selector and is connected to the selector clutch plate assembly by a linkage within the selector case. The clutch plate is free to slide on the splined end of the selector shaft, which is linked to the accelerator pedal. In the inner position (vacuum unit not operating) a tang on the clutch plate engages with a tang on the starting pedal so that movement of the accelerator pedal operates the starter. In the outer position (vacuum unit opeerating as a result of vacuum in intake manifold) a tang on the clutch plate engages a tang on the throttle plate, which is connected to the throttle shaft running through the selector shaft (with the throttle lever connected to the carburetor throttle mounted on the other end) so that the accelerator pedal controls the carburetor throttle in the usual manner.

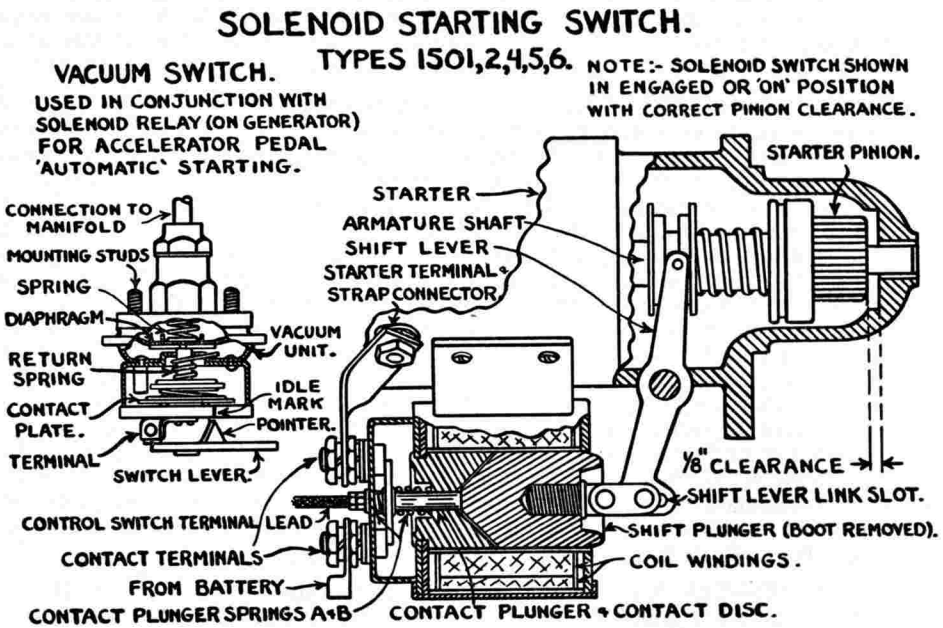
OPERATION:—When the accelerator pedal is depressed, with the engine stopped and ignition turned 'On', the starting pedal will rotate during the first 12° of movement. During the remainder of the accelerator pedal movement all the levers will move together so that the throttle is opened, the starter pinion meshed with the flywheel, and the starting switch closed, allowing the starter to crank the engine. As soon as the engine begins to fire, the accelerator pedal should be released momentarily to relieve the pressure on the selector clutch. The vacuum unit will then declutch the starter pedal and the return spring will demesh the starter pinion and open the starter switch. The accelerator pedal will then control the carburetor throttle in the usual manner as long as thte engine is operating. The vacuum unit will hold the starter out of engagement under all conditions of engine operation. If the engine stalls, the accelerator pedal should be released so that the selector clutch can engage the starting pedal. When the engine is stopped the lack of vacuum disengages the clutch plate from the tang on the throttle plate so that the accelerator lever returns to the starting position. It should be kept in mind that there are two 'closed throttle positions' of the accelerating lever, an 'idling' position with vacuum unit operative, and a 'starting' position with vacuum unit not operative.

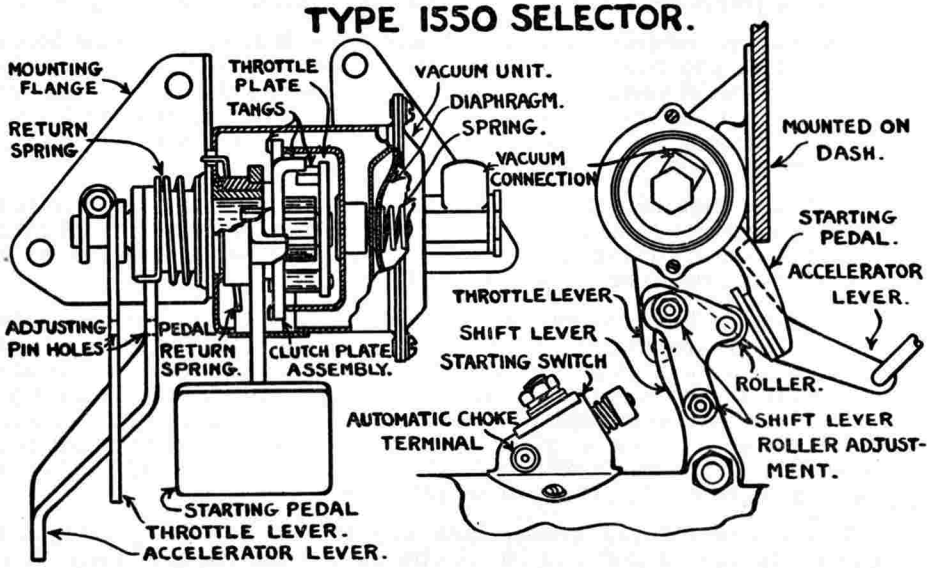
ADJUSTMENT:—Starting Pedal. The roller on the pinion shift lever plate must be directly opposite the center of the starting pedal and there must be 1/16-⅛ inch clearance between the roller and the pedal with the starter inoperative. To adjust, loosen two bolts mounting the plate on shift lever, this will allow plate to be moved up and down and toward the pedal.

Throttle Lever. There are holes drilled through the accelerator lever and throttle lever on the Selector to maintain the alignment while adjusting the carburetor. The throttle lever linkage should be disconnected and a steel pin passed through these holes (a 5/16" drill may be used on the De Soto). With the carburetor correctly adjusted, adjust linkage so that throttle lever may be connected without disturbing position. Remove pin.

De Soto Data. After adjusting as directed in preceding paragraph, check by operating starter with ignition turned 'Off'. While cranking, the clearance between the idle adjustment screw and the stop on the carburetor should be 5/16 inch, corresponding to 1/3 throttle. Then turn ignition 'On' and start engine. With the accelerator pedal depressed, turn ignition 'Off' and depress accelerator pedal as far as possible. With accelerator pedal in this position see that throttle lever on carburetor is wide open and that clearance between accelerator pedal and floor boards is sufficient so that there is no interference. If throttle opening while cranking is more than 1/3, lengthen the adjustable link on the throttle lever of the Selector. If throttle opening is less than 1/3, the link should be shortened.

Assembly of Vacuum Unit. Vacuum unit diaphragm is connected to the clutch yoke hub by means of an adjustable stud. In assembling the unit, turn the entire unit in a clockwise direction until it is tight (farthest position). Then back assembly off until corfrect position as indicated by cover mark is reached. This must be at least ¼ turn; if less than ¼ turn, back





off another complete turn. This will insure sufficient clearance within unit to prevent binding.

All vacuum connections must be tight and there must be no leaks in vacuum lines. This is very important. Also check all linkage for sufficient clearance to prevent interference or binding.

STARTER CONTROLS

MODELS 1502 (BUICK 33-50), 1501 (BUICK 33-60, 80, 90) STUTZ SV-16 (1933), DV-32 (1933)

DESCRIPTION:—The solenoid switch, mounted rigidly on the starter field frame, consists of a pointed end plunger which is free to move within a double coil winding and is linked to the pinion shift lever. The pinion shifting linkage is similar to other Delco-Remy installations and the starter drives through an overrunning clutch. One end of the coil winding is connected to the small terminal on the end of the unit. This terminal is connected through the 'remote control switch' or push-button starting switch to the coil side of the ignition switch so that the control is operative only with the ignition turned 'On'. The other end of the coil winding is grounded. The two large terminals on the end of the unit are the starting switch contact terminals and are connected to the battery and the starting motor (through a strap connector).

OPERATION:—When the remote control switch is pressed with the ignition turned 'On' the solenoid is energized and the plunger is drawn into the coil. This causes the shift lever to mesh the pinion with the flywheel. The pointed end of the plunger then presses on the end of the contact plunger, forcing the contact disc against the starting switch terminal contacts and completing the starting circuit. This permits the starting motor to crank the engine. The movement of the contact disc toward the contacts compresses the contact plunger spring 'A' in front of the disc and when the disc stops against the contacts the further movement of the contact plunger compresses the spring 'B' on the contact plunger shaft in back of the contact disc. These springs insure a good contact between the contact disc and the terminal contacts and instantly break the circuit by movement of the disc when the remote control switch is released. The second coil winding is designed to instantly neutralize the magnetic field of the coil when the coil circuit is opened and allows the return spring on the shift lever to quickly demesh the pinion.

If the starting motor stalls for any reason when cranking the engine, the pinion will be held in mesh by the pressure between the teeth of the pinion and the flywheel, but as soon as the remote control switch is released the contact plunger spring 'A' will move the contact disc away from the contacts, forcing the plunger back the distance of the slot in the linkage. The opening of the starting motor circuit by this movement of the contact disc will relieve the pressure on the pinion teeth and permit the return spring to demesh the pinion.

ADJUSTMENT:—There is only one adjustment on the solenoid switch. With the solenoid plunger bottomed in the coil, the clearance between the end of the pinion and the starting motor drive housing must be ⅛ inch. This adjustment is made by taking out the pin in the linkage which passes through the shift lever slot and turning the stud in the plunger in or out until the correct setting is secured. In making this adjustment the starter should be off the car and the plunger must be held in position in the coil, preferably by the magnetic attraction of the coil. First, disconnect the starting motor from the solenoid switch by taking off the strap connector, close the circuit between the control terminal on the switch and the battery and press the plunger in until it is held in position by the coil. Then take out the linkage pin, position the pinion so that there is exactly ⅛ inch clearance between the end of the pinion and the housing, turn the adjusting stud in the plunger until the pin can be inserted in the slot in the shift lever so that it bears against the rear end of the slot (see illustration) without disturbing the position of the shift lever or the plunger.

MODELS 1504, 1505, 1506 (CHRYSLER AND DODGE, 1933)

DESCRIPTION:—These solenoid switch units are exactly the same as the units used on the Buick models insofar as the construction, mounting and adjustment of the unit is concerned. The control, however, is automatic, employing a vacuum switch and solenoid relay instead of the 'remote control switch' or push-button. The vacuum switch is connected to the accelerator pedal linkage so that depressing the accelerator pedal (with the engine stopped) serves to start the engine. The vacuum switch is held open by the intake manifold vacuum and a latch is used so that the switch is inoperative while the engine is running even at full throttle with consequent low manifold vacuum. The relay solenoid on the generator also holds the control circuit open as long as the generator is operating and acts as an auxiliary control device. Either unit will control the solenoid switch independently in case of failure of the other unit. The control circuit is connected to the ignition switch so that the starter may be operated only with the ignition turned 'On'.

OPERATION:—Vacuum Switch. The vacuum switch lever is connected to the accelerator pedal linkage so that the switch lever is rotated whenever the accelerator pedal is depressed. With the engine stopped, when there is no vacuum in the manifold, the contact plate and contact surface in the switch will be pressed together by the switch spring. When the accelerator pedal is depressed with the ignition turned on, the rotary movement of the switch lever will complete the circuit through the switch, energizing the solenoid switch and allowing the starting motor to crank the engine. When the engine begins to fire, the vacuum in the manifold will cause the vacuum switch diaphragm to open the switch circuit and latch the contact plate in the running or 'Open' position so that the control circuit is open and subsequent movement of the accelerator pedal will have no 'starting' effect as long as the engine is running. If the engine stalls with the car 'free-wheeling' and the accelerator pedal in 'closed throttle' position, the contact plate will be unlatched so that the next movement of the accelerator pedal will crank the engine. If the starting motor stalls while cranking the engine, releasing the accelerator pedal will open the vacuum switch circuit and allow the return spring to demesh the starter pinion in the usual manner.

Solenoid Relay. The solenoid relay is built in the cut-out relay case on the generator field frame. The current from the vacuum switch flows through the solenoid relay winding to ground through the generator. This energizes the relay, closes the relay contacts, and allows current from the battery to flow to the coil winding of the solenoid switch (see illustration of wiring). The solenoid relay contacts close at 4.3-4.7 volts and will remain closed while cranking until the battery voltage drops to 2.0 volts or less. As soon as the engine fires and the generator voltage builds up so that the difference between the generator voltage and battery voltage is less than 2.0 volts the solenoid relay contacts open. If the engine stalls and the generator voltage drops to zero the closing of the vacuum switch contacts by the movement of the accelerator pedal will again energize the solenoid relay.

ADJUSTMENT:—The adjustment of the solenoid switch mounted on the starter is same as given for Buick models (above). In addition, the Vacuum Switch and Solenoid Relay will require adjustment.

Vacuum Switch. There is a pointer on the vacuum switch lever which should be directly opposite the white line on the switch case with the throttle closed, or in idling position. To make this adjustment, first adjust carburetor for correct idling setting, then disconnect switch linkage and adjust so that pointer on lever is opposite line on switch case. See that all vacuum connections are tight and that there are no leaks in vacuum line to manifold. Any leakage will interfere with correct operation of the switch.

Solenoid Relay. Contact gap of solenoid relay should be .050-.055 inch. Air gap should be .007-.009 inch with contacts closed. Contacts should close at 4.3-4.7 volts and open at 2.0 volts or less. See that all connections are tight and check generator performance.

ELECTROLOCKS

TYPES 15-S, 16-B, 16-S, 17-A, 17-S

DESCRIPTION:—These Electrolock ignition switches incorporate a change in design from the Types 15-S and 15-SD in that the primary lead from the switch to the coil is armored and the breaker lead from the coil is not taken through the switch but is connected directly to the distributor (see wiring illustrations). The Types 17-A and 17-S do not have this armored cable. The location of the terminals on the lock case differs with the various types (see illustration). Electrolocks designed for use with Startix automatic starting switch have two 'On' positions, one for use in timing with ignition connected but Startix inoperative, and the second position with both ignition and Startix operative. This second position is the regular operating position of the switch. Details on each type switch are given on the car data sheet ('On' positions may be left and right or both to the right of the 'Off' position).

INSTALLATION LIST

Car and Model	Year	Type	Number	Without Lock Cylinder
Continental—C-400	(1933)	16-S	5174	5075
Continental—C-600	(1933)	16-S	5174	5075
Hudson Super Six	(1933)	16-S	5173	5010
Franklin Olympic 18	(1933)	17-S	4990	.....
Hupmobile Six-K	(1933)	16-B	5088	5176
Nash—Big Six 1120	(1933)	16-S	5173	5010
Nash—Std. 8 1130	(1933)	16-S	5173	5010
Reo—Flying Cloud S-2	(1933)	16-S	5121	5170
Reo—Royale Eight N-2	(1933)	16-S	5128	5171
Packard—1001, 2	(1933)	16-S	5002	5102
Packard—1003, 4	(1933)	16-S	5002	5102
Packard—1005, 6	(1933)	15-S	5039	5175
Willys—77 Four	(1933)	17-A	5159	4937
Willys—99 Six	(1933)	16-S	5172	5046

SERVICING:—Switch Assembly—all types. Remove the lock from the mounting and disconnect all wires from terminals. Then turn back stakings and remove lock case cover. Take out all terminal screws and bushings and pull out contact base assembly and rotary contact assembly for inspection. In reassembling, replace all parts in reverse order and stake case securely.

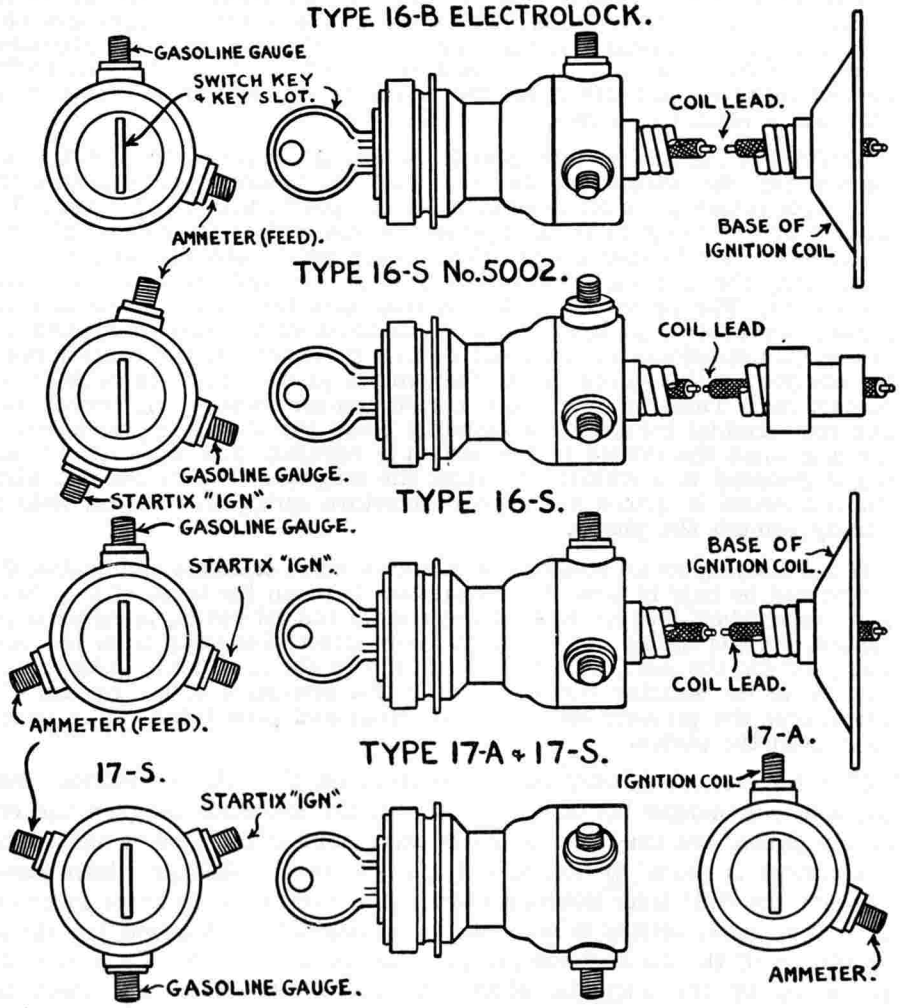
Briggs & Stratton Lock Cylinders on Type 15-S. To service these lock cylinders, first remove lock from mounting, disconnect Startix wiring, turn key to right hand 'running' position, insert pointed tool in small hole in side of lock case, pry and push on lock cylinder spring retainer until lock cylinder can be withdrawn.

Briggs & Stratton Lock Cylinders on Types 16-B, 16-S. To service these lock cylinders, first remove lock from mounting, disconnect ammeter lead and turn key to extreme right hand position, insert a 1/16 inch diameter pin as far as possible in hole in side of lock case, pull lightly on key until lock cylinder can be withdrawn.

Yale & Towne Lock Clinders on Types 16-S, 17-S. These lock cylinders are removed for servicing in the same manner as the Briggs & Stratton lock cylinders used on the Types 16-B, 16-S. Follow directions in paragraph above.

Independent Lock Cylinders on Type 16-S—#5174. To service these lock cylinders, first romove lock from mounting, disconnect ammeter lead, turn key to extreme right hand position, press down on retaining pin (which projects into the small hole located at the top of the threaded front end of the lock case) with a small pointed tool until lock cylinder can be withdrawn.

Independent Lock Cylinders on Type 16-S—#5172, 17-A—#5159. To service these lock cylinders, disconnect ammeter lead, turn key to extreme right hand position, withdraw key, insert special 'extracting key', press key in as far as possible until lock cylinder can be withdrawn. These special 'extracting keys' will be sold only to authorized service stations and the number of the lock for which they are to be used must be specified (see list below).



TROUBLE SHOOTING:—Test circuits through the switch, using a lamp and test points, for each switch position to determine if switch is operating correctly. If switch appears to be defective, disassemble as directed above and examine. It should be remembered that Startix terminal is connected to feed terminal only with the switch key in the 'running' position and is not connected with the switch in the 'timing' position.

DELCO-REMY IGNITION SWITCHES

TYPES 536 AND 537 COIL

DESCRIPTION:—These ignition locks differ from previous designs in that the primary lead or 'feed' wire from the switch to the coil is armored instead of the breaker lead. The breaker lead from the coil is not taken through the switch but is connected directly to the distributor.

OPERATION:—**Type 536 (Chevrolet).** This type lock is operated by inserting the key and turning key to the right until the lock cylinder springs out slightly. The key can be withdrawn with the switch turned 'on'. The switch is turned 'off' merely by pressing in on the lock cylinder until it is caught in the innner position. With the switch 'off' both the gasoline gauge terminal and ignition coil are grounded so that it is impossible to wire around the switch.

Type 537. On this type switch the lock cylinder does not spring out and the turning of the key completes the ignition and gasoline gauge circuits. The key cannot be removed with the switch on. The gasoline gauge terminal and ignition coil are grounded with the switch turned 'off'.

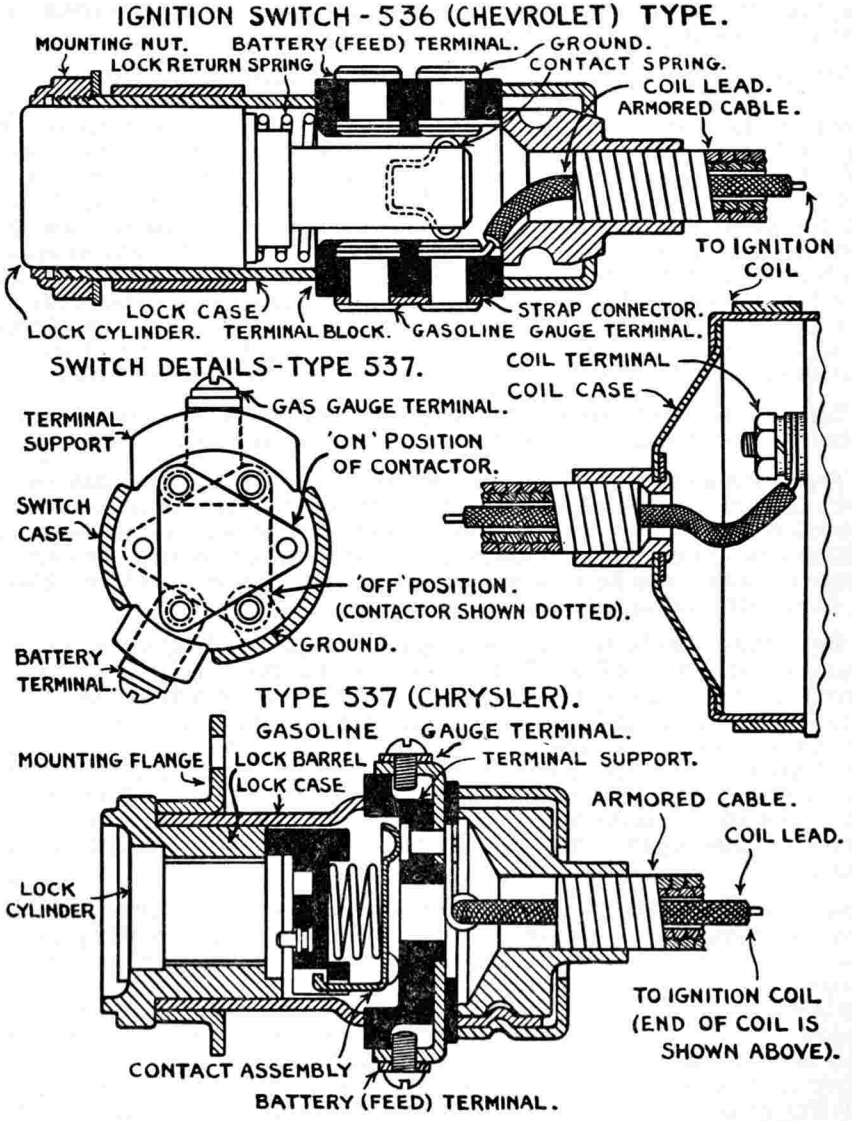
INSTALLATION LIST

Car Model		Year	Coil Assembly
Chevrolet	Std. and Mstr.	(1933)	536-W (Switch and Lock 428-A).
Chrysler	CO-Six	(1933)	537-U
Chrysler	CT-Royal 8	(1933)	537-L, 537-K.
Chrysler	CQ-Imp. 8	(1933)	537-U, 537-M.
De Soto	SD-Six	(1933)	537-S, 537-Y.
Dodge	DP-Six	(1933)	537-V.
Dodge	DO-Eight	(1933)	537-Y.
Graham	65-Std. 6	(1933)	536-U.
Graham	64-Std. 8	(1933)	536-U.
Graham	57-A Cust. 8	(1933)	536-U.

TROUBLE SHOOTING:—Circuits through the switch should be tested with a lamp and test points to determine if the switch is operating satisfactorily. In making the following tests place the test points on the points indicated and note whether the lamp lights or not.

1. Switch off. Disconnect feed wire on switch. Test from feed terminal to to gasoline gauge terminal. Lamp should not light.
2. Switch off. Disconnect feed wire on switch. Test from gasoline gauge terminal to switch case or armored cable. Lamp should light.
3. Switch on. Disconnect feed wire on switch. Test from gasoline gauge terminal to feed terminal. Lamp should light.
4. Switch on. Disconnect feed wire from switch. Test from feed terminal to breaker terminal of ignition coil. Lamp should light. If lamp does not light and previous test indicated switch circuit was satisfactory, coil should be disconnected and tested separately (see next paragraph).
5. Switch on. Disconnect feed wire from switch and block open breaker contacts or disconnect breaker lead at coil. Test from feed terminal on switch to switch case. Lamp should not light. If lamp lights, the switch, coil lead or ignition coil are grounded. Disconnect coil and test separately.

SERVICING COIL:—The coil assembly can be serviced either by replacing the entire unit or by disconnecting the coil and replacing the coil or the switch and cable assembly. The entire unit should first be taken off the car by disconnecting the switch leads and removing the switch from the instrument board mounting and removing the ignition coil from the dash mounting. Then bend up the ears that hold the cup on the end of the cable in place on the coil. This will expose the primary terminal at the base of the coil. Disconnect primary lead in the cable from this terminal, connect the new coil and bend down the ears so that the new coil is securely held on the cable.



BOSCH MAGNETO

TYPE JR 'RAPID TRANSIT' TYPE

DESCRIPTION:—These magnetos are of the rotating field magnet, stationary coil and breaker type. The magnet assembly, consisting of five cobalt steel plate magnets, forms the rotor which is mounted on ball bearings. The stationary armature or coil assembly is mounted directly above the rotor on the upper ends of the laminated pole pieces so that the magnetic field is completed through the laminated coil core. The direction of the magnetic field is changed twice for each revolution of the rotor shaft so that the magnetic field is completed through the laminated coil core. The direction of the magnetic field is changed twice for each revolution of the rotor shaft so that the magneto produces two sparks per revolution and must be driven at 1½ times crankshaft speed on a six cylinder engine.

The breaker assembly and distributor are mounted in a tower at one end of the magneto and the vertical distributor shaft is driven by spiral gears from the rotor shaft. The primary lead from the coil to the breaker runs through the frame or housing on the distributor end of the magneto and into the distributor cup directly above the timing lever. The coil high tension current is taken from the coil through a brush in the brush holder on the drive end of the magneto and then through a flexible lead to the central tower of the distributor cap. A special waterproof cover is mounted on top of the distributor cap and all high tension cables emerge from under the lower edge of this cover. When the magneto is furnished with automatic spark advance the advance mechanism (centrifugal weight governor type) is mounted on the lower section of the distributor drive shaft in the distributor tower. These magnetos are built in three distinct types.

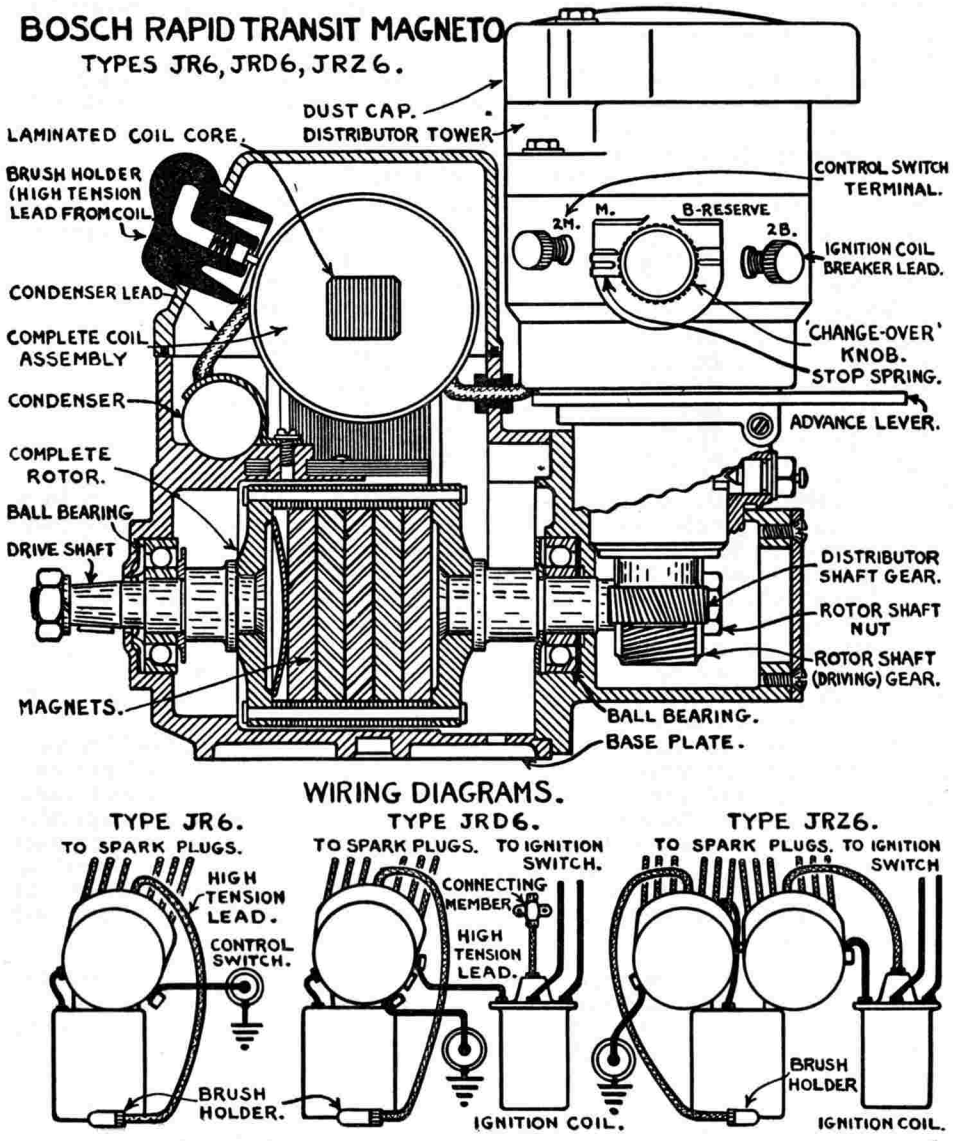
Type JR-6—Single Spark Plug Magneto Ignition. This type has a single interrupter or breaker assembly and is furnished with manual spark control.

Type JRD-6—Dual Magneto or Battery Ignition. This type has two distinct interrupter assemblies with a simple changeover device so that the second set of contacts can be used as a reserve or emergency set with an ignition coil to provide an emergency battery ignition system. Magneto and battery ignition can be used alternately but not at the same time. Magneto is fitted with automatic spark advance.

Type JRZ-6—Twin Ignition. This magneto has two distributor towers and two distinct distributor and breaker assemblies. Both distributor shafts are driven by the spiral gear on the rotor shaft. One distributor tower (right hand facing distributor end) is used for magneto ignition and fires one set of spark plugs on the engine. This distributor is similar in design to that used on the JR-6 and has a single set of contacts. The battery ignition distributor (let hand facing distributor end) has two sets of breaker contacts and in conjunction with an ignition coil fires the second set of spark plugs on the engine. This type magneto is fitted with manual spark advance.

TIMING MAGNETO TO ENGINE:—Magnetos must always be timed to the engine with spark control levers advanced and the advanced firing point for the particular engine must be determined. With the engine crankshaft turned to this advanced firing point for piston No. 1, and with the magneto distributor cap removed (take out two screws and lift off cap), turn the magneto shaft until the rotor segment or electrode is directly opposite the red line on the upper edge of the distributor cup. See that spark advance levers are in the advanced position (on the JRZ-6 the lever is on the end of the drive shaft and is returned to the advanced position by a spring behind the drive gear on the rotor shaft). Continue to turn the magneto drive shaft carefully in the direction of rotation until the breaker contacts begin to open (do not use paper strips to check contact opening, if this method is used employ thin steel strips not over .03MM. or .001 inch in thickness.) Couple the magneto to the engine, being careful not to disturb relative position of magneto drive shaft and crankshaft.

In timing the Type JRD-6 magneto, the magneto breaker contact must be used and the change-over knob must be in position to allow the breaker arm of this set of contacts to be in contact with the cam (see paragraph below). On the Type JRZ-6 magneto, the distributor cap on the magneto distributor (right hand distributor viewed from distributor end) should be



BOSCH MAGNETO

TYPE JR 'RAPID TRANSIT' TYPE

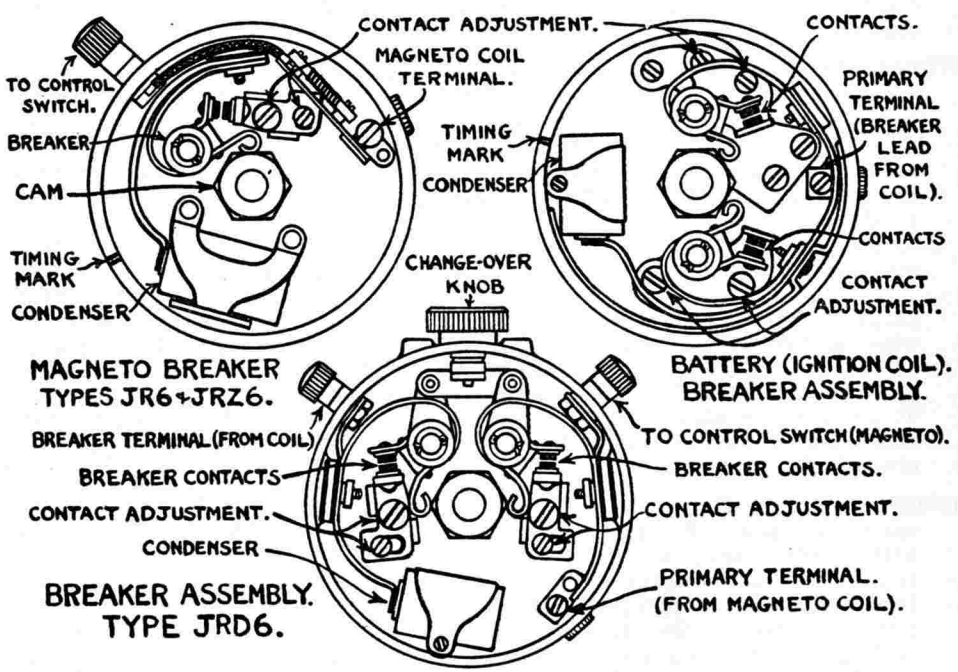
removed and these contacts used to time the magneto to the engine. The battery contacts will be correctly timed to the engine if the battery distributor has not been removed or the timing screws (the copper plated screws on the breaker plate) disturbed.

SERVICING:—At intervals of 20,000 miles or 30,000 kilometers, the distributor caps should be removed and the breaker contacts inspected. If necessary the contacts should be resurfaced with a fine, flat contact file and the breaker gap adjusted. Breaker contact gap should be set at .3MM. or .012 inch (minimum)—.4MM. or .0157 inch (maximum). to adjust contacts, loosen lock screw on stationary contact mounting plate and turn eccentric adjusting screw until gap is within above limits with breaker arm on the lobe of the breaker cam (use a feeler gauge to insure accuracy). The battery breaker contacts on the Type JRZ-6 should also be inspected, resurfaced, and adjusted if necessary. In adjusting these contacts none of the copper plated screws on the breaker plate should be loosened as this will affect the ignition setting. On the Type JRD-6, the change-over knob must be in position for magneto ignition when the magneto contacts are checked and adjusted. The battery contacts will need adjustment only if battery ignition has been used extensively. In this case turn the change-over knob 180° counter-clockwise from the position marked 'M' to the position marked 'B-Spare' before the battery contacts are checked and adjusted.

LUBRICATION:—The ball bearings on both the rotor shaft and distributor shaft are packed with a heat-resisting grease which should not require renewal between overhaul periods. Whenever the magneto is disassembled for inspection or overhaul the bearings should be cleaned and repacked with this special grease (melting point 175°C.). The drive gear case is filled with 'ambroleum' which should not require any attention.

WIRING:—See illustrations for complete wiring diagrams of each magneto type. The terminal on the side of the distributor marked '2M' on each type should be connected to the magneto short-circuiting switch. The other side of the switch is grounded. Whenever work is being done on the car wiring or circuits are being tested, the magneto ground wire should be disconnected at the '2M' terminal in order to avoid any possibility of current flowing through the magneto windings and demagnetizing the magnets.

CHANGE-OVER ON TYPE JRD-6:—See wiring diagram for details of complete installation of the Type JRD-6 magneto, ignition coil and change-over couplings. The magneto is designed to operate ordinarily as a simple magneto ignition installation controlled by the short-circuiting or ground switch. If it is desired to use battery ignition for any reason, the change-over knob on the side of the distributor should be turned 180° counter-clockwise from the 'M' point to the 'B-Spare' position. The spring on the pointer will snap into place at each position. The screw plug on the high tension lead at the brush holder on top of the magneto case should then be unscrewed and the lead pulled out of the brush holder. This lead should then be inserted in the open end of the coupling or connecting member to which the coil high tension lead is connected. There is a needle point at the base of the socket which enters the end of the cable, insuring a good contact. The cable plug should then be screwed in firmly so that the cable is gripped and cannot be withdrawn. This completes the change-over and the engine can be operated on battery ignition by turning on the ignition coil switch. In order to operate the engine on magneto ignition again it will only be necessary to return the high tension lead to the brush holder on the magneto (the connection is made in the same manner as on the coupling, and rotate the change-over knob clockwise to the 'M' position.



The change-over knob controls the breaker contacts through a cam action and lifts the breaker arm not being used free of the breaker cam so that the contacts remain open. The timing of the engine is not affected by this action so that it is not necessary to retime the magneto when it is changed over from magneto to battery ignition. However the magneto contacts can only be checked and adjusted when the change-over knob is in position 'M' and the knob must be turned to position 'B-Spare' before the battery contacts are adjusted.

BENDIX MAGNETO

TYPES C-4 AND C-6

DESCRIPTION:—These magnetos are manufactured by the Scintilla Magneto Company and embody the rotating magnet and stationary coil and breaker as found in Scintilla Magnetos. They are designed for automotive, marine and stationary engine installation. Magnetos are completely enclosed for protection in service (ventilation is provided for by wire gauze covered ventilating windows) and housings can be removed for inspection and adjustment without special tools. Magnet shaft and distributor rotor are mounted on ball bearings which are packed with grease at overhaul periods and require no lubrication in service. Breaker contacts are easily adjusted with a screwdriver and entire breaker assembly is quickly removable by releasing a spring catch. All connections are made by means of bronze leaf springs.

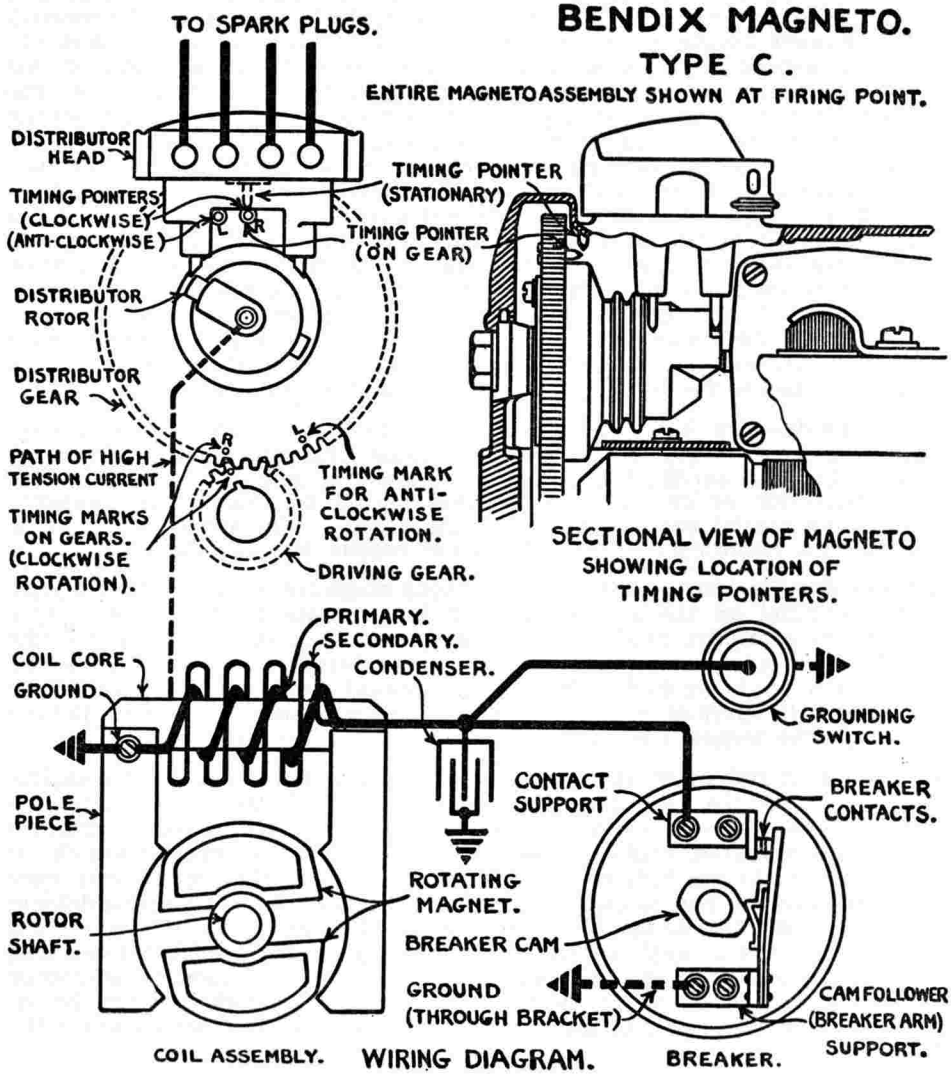
INSTALLING MAGNETO:—Adjustment of Timing Range Scale. Spark advance range of magneto must be set for the particular engine on which magneto is installed. Advance range is adjustable up to 45° for rotation in either direction by means of the Timing Range Scale mounted on the back of the breaker housing (see illustration 3). When the figure '45°' in the center of the scale is opposite the arrow on the housing, the magneto is set for 45° maximum advance with rotation in either direction. To set advance range, loosen the two screws 'A' on the scale and shift the scale itself to the correct position. On magnetos for clockwise rotation (drive end) shift the scale to the left over the range marked 'L' to decrease the spark advance range (each division on the scale is 15°). On magnetos for counter-clockwise rotation (drive end), shift the scale to the right over the 'R' portion of the dial to decrease the timing range. Timing range must be set in accordance with engine manufacturers' specifications. On magnetos driven at 1½ times engine speed the setting as indicated on the Timing Range Scale should be 1½ times the desired range as measured on the engine crankshaft.

TIMING:—Timing Magneto to Engine—when crankshaft setting for full advance is known. Turn engine to correct firing position for No. 1 piston with spark advanced. Advance magneto spark control lever, take off distributor head, disengage impulse coupling when used. Turn magneto drive shaft until timing pointer on face of large distributor gear lines up with timing pointer inside magneto main cover (at top of magneto—see illustration). Couple magneto to engine (see paragraph on adjustable drive member).

When Advance Firing Point is Not Marked. Set Timing Range Scale to correspond with the specified maximum advance for the engine (where magneto is driven at 1½ times crankshaft speed, Timing Range Scale setting must be 1½ times specified advance). Turn engine to top dead center firing position for piston No. 1. Retard magneto spark advance lever and time magneto to engine by turning magneto drive shaft until breaker contacts begin to open (slightly after position when timing pointer on large distributor gear lines up with timing pointer on magneto frame).

Fixed Spark Ignition when Advance Point is not Marked. Set Timing Range Scale to amount of fixed spark advance before top dead center desired. Time magneto to engine with spark advance lever retarded and piston No. 1 at top dead center as directed in paragraph above. After timing has been completed, remove contact breaker from magneto, reset Timing Range Scale at '0' for correct rotation, replace breaker on magneto. This will provide Fixed Spark Ignition with the setting at the correct point before top dead center.

Adjustable Drive Member. An adjustable drive member is designed to be mounted on the engine drive shaft. This drives the magneto through two dogs on its outer face which engage with a flexible fabric center disc which in turn engages two dogs on the magneto coupling member. The adjustable drive member should be set when the magneto is timed to the engine initially. The drive member consists of an inner hub keyed to the drive shaft with worm teeth on its outer circumference. These teeth engage with the adjusting screw in the outer or dog plate member. The screw also clamps the entire drive member together after the setting has been made. With the magneto shaft turned to the firing position and the engine crank-



BENDIX MAGNETO

TYPES C-4 AND C-6

shaft turned to firiing position for piston No. 1, center the central disc of the coupling on the magneto shaft coupling member, then with the cotter removed and castellated nut on the adjusting screw loosened, turn the adjusting screw in until it has turned the dogs on the drive coupling into position so that they are centered on the slots of the central disc. When adjustment has been completed clamp the dog plate securely in position by tightening the castellated nut on the adjustment screw and replacing the cotter pin. In making the adjustment the screw should always be turned clockwise or in, as reversing the direction will only back the screw out of the dog plate.

Impulse Couplings. Heavy duty Bendix Impulse Couplings have been developed for installation on these magnetos. As usually installed, the couplings are automatic; that is, the impulse coupling automatically engages whenever the engine is cranked and is automatically disengaged at the throw-out speed. Impulse couplings may be manually engaged and disengaged with engine running or stopped by means of buttons on top of the coupling. The center button marked 'ON' should be depressed to engage the coupling. The other button marked 'OFF" should be pressed to disengage the coupling. The 'ON' button should not be pressed with the magneto operating at high speeds. Impulse couplings must always be disengaged when the magneto is being timed to the engine. Impulse couplings are lubricated when installed and require no attention in service. The felt washer between the coupling housing and dust cover is saturated with graphite grease and should be given a drop of oil occasionally.

SERVICING:—Inspection of Contacts. At intervals of 500 hours or 10,000 miles of operation, remove breaker cover and see that lubricating felt attached to cam follower is saturated with oil. This felt oils the breaker cam surface and should be given one or two drops of medium oil if necessary. Check contact setting by cranking engine to firing position of piston No. 1, advance magneto spark control lever, see that timing pointer on large distributor gear lines up with pointer on housing main cover, check contacts, which should begin to open at this point. If contacts are not opening, loosen two mounting screws on contact support block, shift block to one side or the other until contacts begin to open. There is a slot in the breaker housing on each side of the support block which serves as a purchase point for the screwdriver in shifting the support. A very slight movement should be sufficient to adjust contacts. Tighten mounting screws after completing adjustment. It is not usually necessary to check contact gap but this should be approximately .018" maximum.

Alignment of Breaker Contacts. Movable contact can be adjusted vertically and horizontally to properly align contact with stationary contact. Horizontal adjustment is made by inserting a shim of correct thickness under the cam follower support. This is necessary only when new contacts are installed and should be done by a Scintilla Service Station. Vertical adjustment of the cam follower is made by shifting the cam follower support slightly. The hole in the support for the mounting screw '2' is slightly elongated, permitting this adjustment. To adjust, loosen the two mounting screws slightly, move the contact support up or down, as necessary, to align contacts, tighten mounting screws, recheck alignment.

LUBRICATION:—At intervals of 1,500 hours, or 30,000 miles of operation, the magneto should be disassembled and inspected for wear. The ball bearings of the rotating magnet or drive shaft should be washed with gasoline and repacked with No. 44 Keystone grease or equivalent. Grease should also be applied to teeth of the distributor gear.

At 3,000 hour or 60,00 mile intervals the large distributor gear and distributor should be removed and disassembled, the bearings washed in gasoline and repacked with grease.

STARTIX CIRCUIT BREAKER

DESCRIPTION:—This device is an automatic circuit breaker designed to open the Startix circuit and prevent automatic cranking momentarily whenever a backfire occurs. It is designed to be screwed in the intake manifold and is operated by the pressure built up in the manifold when the backfire occurs. The two terminals on the side of the Circuit Breaker case should be connected as follows: Terminal marked 'IGN' to Startix terminal on ignition switch (feed terminal), Terminal marked 'STARTIX' to 'IGN' terminal on Startix case. These connections must not be reversed as incorrect connections will interfere with the proper action of the Circuit Breaker.

OPERATION:—The pressure built up in the manifold by the backfire causes the plunger within the Circuit Breaker case to move upward, closing a set of contacts on a thermostatic arm and short-circuiting the current from the ignition switch through the thermostatic arm to ground. The thermostatic arm is heated and is flexed upward, opening the main contacts and breaking the circuit to the Startix switch, thus stopping the automatic cranking of the engine. As soon as the crankshaft stops moving backward and the pressure in the intake manifold drops, the plunger drops down, opening the thermostatic arm contacts, breaking the circuit through the thermostatic arm and permitting the arm to cool. After several seconds the arm flexes downward, closing the main contacts and the Startix switch will then resume the cranking operation. The entire action of the Circuit Breaker is automatic. It must be kept in mind that several seconds will intervene between a backfire and the resumed cranking.

SERVICING:—The Circuit Breaker requires no service operations. Connections should be kept tight and care must be taken that the unit is correctly hooked up ('IGN' terminal on unit should be connected to ignition switch and 'STARTIX' terminal connected to 'IGN' terminal on Startix case). If the Circuit Breaker does not operate satisfactorily it should be replaced by a new unit.

SPARTON RADIO

MODEL 34

DESCRIPTION:—The Model 34 is a seven-tube Superheterodyne receiver designed for mounting on the dash or under the floor boards on the car. The set can be used with dry cell 'B' batteries or a 'B' Eliminator. A new type automatic volume control is incorporated in the set. The car battery is used for the 'A' current supply (set requires approximately 2.8 amperes).

Tubes used are as follows: One Type 39 Tube as Radio-frequency amplifier, one Type 36 Tube as Detector-Oscillator, one Type 39 Tube as Intermediate-frequency amplifier, one Type 70 Tube as Second Dectector-AVC, one Type 37 Tube as Audio-frequency amplifier, two Type 38 Pentode Tubes in the power output stage (push-pull amplification).

INSTALLATION:—The set is supplied with the remote control unit disconnected. Receiver can be mounted on the dash or in a box mounted in a hole cut through the floor boards of the car. When through-the-floor mounting is used, the waterproof box or container must be positively grounded by running a heavy wire from the mounting lug on the box to the car frame.

Remote Control Unit. After the Control Unit has been mounted on the steering column, the tuning cable must be connected to the condenser drive pulley on the receiver. To connect drive cable, insert cable and sheath in chuck on side of receiver so that sheath extends one inch into receiver case, tighten chuck so that sheath is held securely, turn Control Unit dial to 540 kilocycles, turn tuning condenser pulley so that top of rotor plates are flush with top of stator plates, slip tuning cable under clamp on pulley, tighten clamp screw and bend end of cable over into opening on flange so that cable will not bind on pulley guard. This loose end on the cable should not be more than ½". If necessary, the tuning cable can be shortened to fit particular installations. To shorten cable, measure length desired, allow 2¼" additional length for connection inside receiver case and cut both control cable and sheath at this point. Then take off cover on Control Unit, remove three screws on plate holding cable sheath, slide sheath down on cable and cut off 1¾" of sheath at receiver end. Slide sheath back into position and refasten. This will allow control cable to extend 1¾" beyond the end of the sheath. The end of the control cable should be tinned with rosin core solder to prevent it unraveling. Connect cable to receiver as directed above.

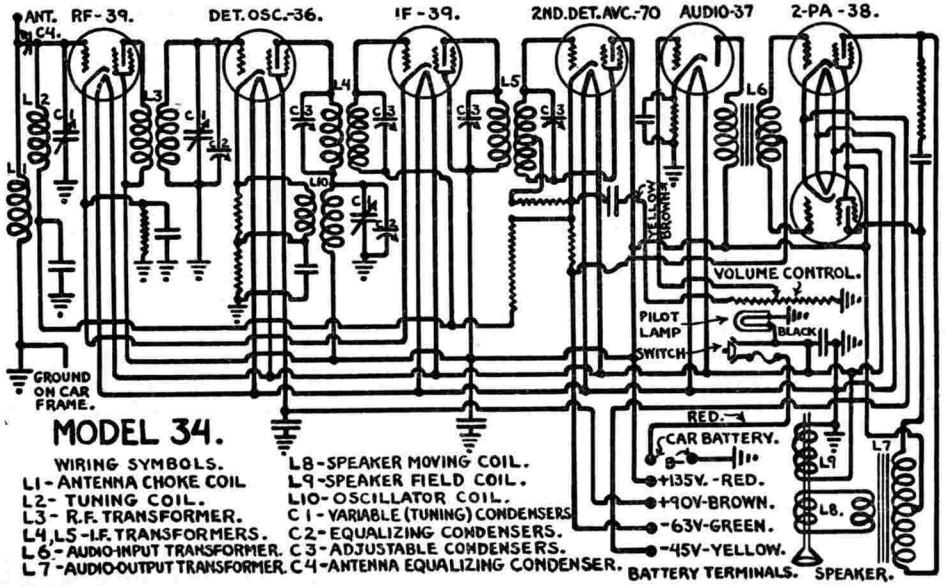
To check cable setting, tune in a station of known frequency between 700 and 900 kilocycles and note dial reading. If dial reading does not correspond with station frequency, turn dial to correct figure, loosen sheath in chuck and slide sheath in or out of chuck until station is properly tuned in, tighten chuck.

Junction Block. A junction block is used to connect the Control Unit cable and the cable from the receiver to facilitate removing either unit for service. The seven wire harness leads from the Control Unit are soldered to the terminals on the junction block at the factory. In connecting the receiver, the leads in the receiver cable are connected to the terminal to which is fastened the same color wire from the Control Unit. The shielded black wire from the junction block is the 'A' supply lead and should be connected to the ungrounded terminal on the car battery. This lead should be cut to length, fitted with a connecting lug and the shielding cut back one inch from this terminal and taped. The shielding should be grounded. When the set is operated with dry cell 'B' batteries the 'B' Eliminator junction block terminals are not used.

Fuses. A ¼-ampere capacity fuse is connected in the 'B' battery jumper wire in the battery box. A 10-ampere capacity 'A' battery fuse is mounted on the Control Unit. No other size fuses should be used.

'B' Batteries. Four 45-volt 'B' batteries and one 22½-volt 'C' battery are mounted in the battery box. Battery box is designed to be mounted through the floor of the car. Three of the 45-volt 'B' batteries are connected in series to provide a 'B' voltage of 135 volts. The brown wire in the battery cable is a 90-volt tap and is connected to the '+45' volt terminal of the second battery. The negative terminal of the 'B' battery bank is connected through the ¼-ampere 'B' fuse to the '+45' volt terminal of the fourth battery and from this same terminal to the ground lug on the battery box. The '—' terminal of this fourth battery is connected to the yellow lead in the battery cable and also to the '—3' volt terminal of the 'C' battery. The remaining wire in the battery cable (green) is connected to the '—22½' volt terminal of the 'C' battery and runs to the '—63' volt terminal on the receiver (see illustration). A ground wire should be run from the lug on the side of the battery box to the car frame and the wire leading from the side of the battery cable plug at the receiver end should also be grounded to the car frame. 'B' batteries should be replaced when the voltage of the individual batteries drop to 39 volts or whenever they show signs of corrosion, irrespective of voltage.

INTERFERENCE SUPPRESSION:—The usual spark plug suppressors and by-pass condensers should be installed (see paragraph on Suppression on Model 33). The ignition coil by-pass condenser furnished with this set is fitted with two leads instead of being grounded through the case. One lead should be connected to the ignition switch terminal on the ignition coil and the other lead connected directly to the engine block. The condenser should be clamped to the coil high tension cable and the lead run parallel to the cable (tape the two wires together, do not twist the condenser lead around the cable). These condenser leads should be kept as short as possible. A by-pass condenser should also be connected between one of the ammeter terminals and ground.



ADJUSTMENT:—When the set is installed or whenever the antenna is changed, the antenna equalizing condenser must be adjusted. To make this adjustment, tune in a weak station at a point between 1200 and 1400 kilocycles on the dial (dial is calibrated in kilocycles with the last '0' left off), turn volume control on full, remove cover on antenna condenser adjusting hole (do not remove receiver cover), use an insulated hexagonal-ended socket wrench and turn adjusting nut to right or left until maximum volume is secured.

TROUBLE SHOOTING:—If no means of testing tubes is available, tubes can be checked by replacement (various types of tubes are used, they are not interchangeable). Top and bottom covers on receiver must make a good contact with receiver case, particularly at the antenna condenser end of the receiver. If necessary bend cover or receiver case at several points so that contact is established. The following table of voltages is for use with a Set Analyser (plate current figures are in milliamperes).

Tube	Location	Voltages Filament-Heater	Plate	Control Grid	Screen Grid	Plate Current
39	R.F.	6.3	90	— 3.0	+ 90	4.0
36	Det. Osc.	6.3	120	—15	+ 90	2.0
39	I. F.	6.3	90	— 3.0	+ 90	4.0
70	2nd Det. AVC.	6.3	180			1.0
37	A. F.	6.3	125	—10		4.0
38	Power	6.3	180	—19.5	+180	8-10
38	Power	6.3	180	—19.5	+180	8-10

SPARTON RADIO

MODEL 33 ALL ELECTRIC

DESCRIPTION:—The Model 33 is a six-tube Superheterodyne "all electric" receiver with a built-in full wave rectifier. No 'B' or 'C' batteries are used and all current required for operation of the set is taken from the car battery. The set has automatic volume control and an electro-dynamic speaker is used.

Tubes are used as follows: Two Type 39 Pentode tubes as radio frequency amplifiers. One Type 36 screen grid tube as Detector-Oscillator, one Type 85 Duplex-diode-triode detector and AVC tube, one Type 41 Pentode power output tube, and one Type 84 full-wave rectifier tube.

INSTALLATION:—The set is supplied with the remote control unit connected to the receiver so that it is only necessary to mount the receiver on the rear of the dash and clamp the control unit on the steering column. On cars where it is necessary to mount the receiver on the engine side of the dash (this is not recommended in cases where this type mounting can be avoided), the control shaft and cable must be disconnected so that they can be passed through holes drilled in the dash. The control cable leads should be disconnected at the control unit and not at the receiver end.

Speaker:—A mounting stud is provided on the back of the speaker. Where other means of mounting are used, this stud should not be removed although if necessary it can be cut off at a point one inch from the speaker case.

'A' Battery:—A shielded cable is provided for the 'A' current supply. The red wire in the cable should be connected to the 'hot' or ungrounded side of the car battery and the black wire to the battery grounded terminal. The shielding should be grounded at various points between the receiver and the car battery.

Antenna:—The set should be used with a roof antenna wherever possible. On cars with wooden top bows a copper screen antenna can be installed. On cars with poultry wire top construction, this wire mesh can be used for the antenna by cutting the wire back three inches from the dome light wiring and all metal roof parts and removing all grounds. Dome light wiring should be shielded and the shielding grounded. The lead-in should be shielded from the set to a point about eight inches from the antenna and should be grounded at the antenna end to a metal part of the car.

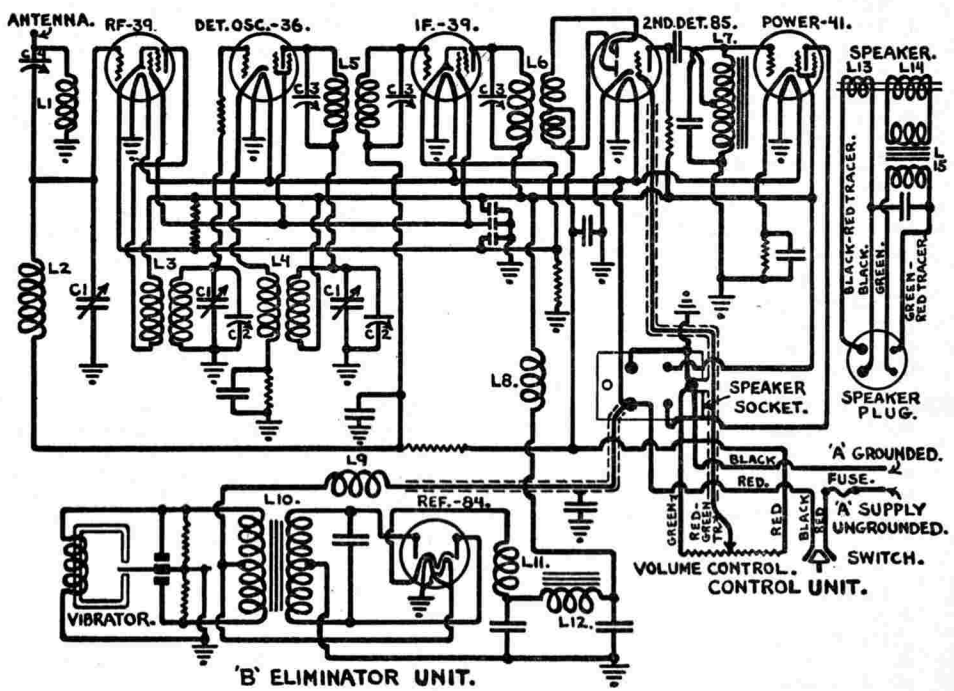
INTERFERENCE SUPPRESSION:—The usual spark plug suppressors should be installed on each spark plug and in the center terminal of the distributor cap. A condenser is furnished which should be mounted on the generator field frame and connected to the generator side of the relay cutout. Where interference is experienced after suppressors are installed as directed above, a second condenser should be connected to the switch side of the ignition coil. The condensers are grounded through the case and must be mounted on a metal surface. Interference caused by the dome light wiring can be checked by disconnecting the dome light lead at the lighting switch or ammeter and grounding this wire to the car frame with the set operating. If this eliminates interference, the dome light wiring should be shielded or a condenser (.25 Mfd. or larger) should be connected from the ammeter terminal to ground. See that all of the receiver cable shieldings are grounded and keep the speaker cable out of the engine compartment. If all other means of eliminating interference fail on cars with the ignition coil mounted on the back of the instrument board and it is not possible to shift the coil (lock coil types), the high tension lead from the coil can be shielded to a point slightly beyond the dash by using standard shielded loom and grounding the shielding.

On the Ford V-8 where it is not possible to install a suppressor between the coil and the distributor, the manufacturer recommends that the carbon brush should be removed from the brush holder directly above the distributing drum and replaced by the carbon resistor taken from one of the standard spark plug suppressors. It will be necessary to drill out about one-half inch of the lower end of brass bushing in which the brush and spring are mounted to prevent arcing. This drilling must be done carefully to avoid breaking the bakelite housing. A bushing must be made up of insulating paper to replace the brass bushing removed so that the brush is held firmly in place.

ADJUSTMENT:—When the set is installed, or whenever the antenna is changed, the antenna equalizing condenser must be adjusted. To make this adjustment, with the set installed and operating, tune in a weak station in the vicinity of 1200-1300 kilocycles on the dial (the last '0' is omitted on the dial figures), remove the cover over the adjustment hole nearest the cable drive end on the under side of the receiver, insert a small insulated screwdriver and turn equalizing condenser screw to the right or left until maximum volume is secured.

Dial Scale:—The dial scale may require resetting to compensate for changes in position of the control unit shaft. To adjust the dial so that the figures will read correctly, tune in a station of known frequency sharply so that maximum volume and minimum hiss is secured. Then insert a thin blade (such as a pocket knife) through the dial opening in the case so that it engages the small holes in the dial. Shift the dial until the dial figure corresponds with that of the station being received.

SERVICING:—The bottom case of the receiver can be removed by taking out the three cover screws. This will expose the tubes for checking or replacement. The entire chassis of the receiver can be removed by taking off the nuts on the three mounting bolts. The 'B' Eliminator is held in place by two screws on the side of the case and can be removed by taking out these screws and disconnecting the leads. The control shaft can be disconnected by taking out the two screws in the flange holding the shaft casing to the bushing on the receiver case. It will not be necessary to adjust the pinion and gear when the shaft is installed as this adjustment is not disturbed when the shaft is disconnected.



C1—Variable (tuning) Condensers.
C2—Equalizing Condensers.
C3—Adjusting Condensers.
C4—Antenna Equalizing Condensers.
L1—Antenna Choke Coil.
L2—Tuning Coil.
L3, L4—Radio-frequency Transformers.
L5, L6—I. F. Transformers.
L7—Auto Transformer.
L8—Cathode Choke.
L10—Power Transformer.
L13—Speaker Field Coil.
L14—Speaker Voice Coil.
L15—Output Transformer.

PHILCO-TRANSITONE RADIO

MODELS 7, 8, 12, 6, 9, B-6

DESCRIPTION:—Model 7. This model is five-tube Superheterodyne receiver designed for operation with the 6-volt car battery and either three 45-volt 'B' batteries or the Model EA Dynamotor. This set has automatic volume control and is equipped with an electro-dynamic speaker.

Tubes used are as follows: 1 Type 36 tube as Radio-frequency amplifier, 1 Type 36 tube as Intermediate-frequency amplifier, 1 Type 36 tube as Detector-Oscillator, 1 Type 38 tube as second-detector and automatic volume control, 1 Type 41 tube for output stage (first sets used a Type 38 tube instead of the Type 41).

Model 8. This model is a six-tube Superheterodyne "all electric' receiver designed for operation with the 6-volt car battery and a Model EA Dynamotor. The set has automatic volume control and is equipped with an electro-dynamic speaker.

Tubes used are as follows: 1 Type 36 tube as Radio-frequency amplifier, 1 Type 36 tube as Detector-Oscillator, 1 Type 36 tube as intermediate-frequency amplifier, 1 Type 38 tube as second detector and automatic volume control, 2 Type 41 tubes as push-pull amplifiers in the output stage.

Model 12. This model is designed for installation on boats or busses equipped with 12-volt batteries. A special Model EC Dynamotor is used for the 'B' supply. Model 12 sets (Code 121) built between August, 1932, and January, 1933, were similar in design to Model 8 except as noted above. After January, 1933, Model 12 sets (Code 122) are similar to Model 9 except for 'A' voltage and the Dynamotor, which is now Model EE.

Model 6. This model is five-tube Superheterodyne receiver designed for operation with the 6-volt car battery and a Model EB Dynamotor. The set has automatic volume control and an electro-dynamic speaker is used.

Tubes used are as follows: 1 Type 36 tube as Radio-frequency amplifier, 1 Type 36 tube as Detector-Oscillator, 1 Type 36 tube as intermediate frequency amplifier, 1 Type 85 tube as second-detector and automatic volume control and audio-frequency amplifier, 1 Type 41 tube in output stage.

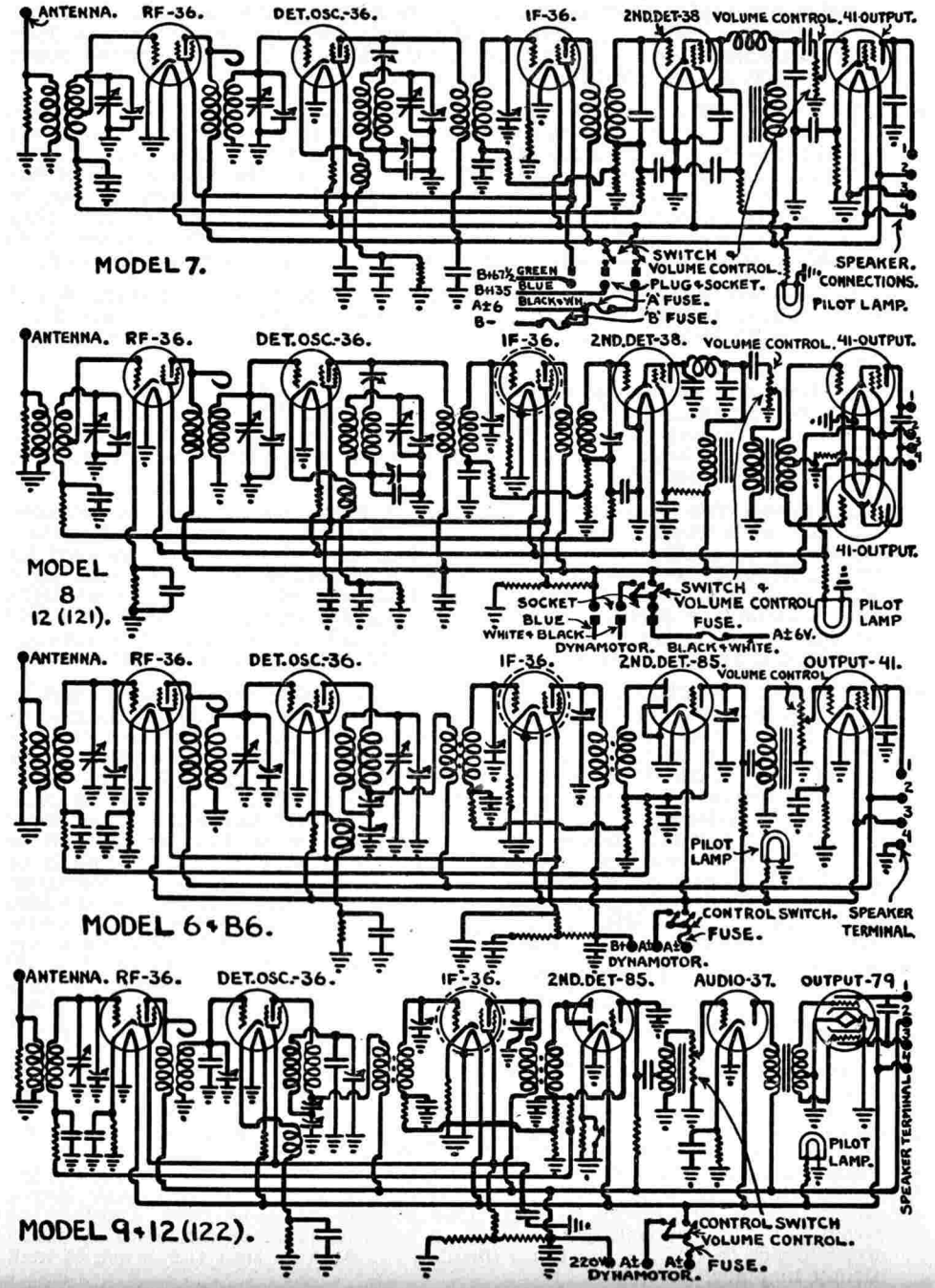
Model 9. This model is a six-tube Superheterodyne receiver designed for operation with the 6-volt car battery and a Model ED Dynamotor. The set has automatic volume control and an electro-dynamic speaker is used.

Tubes used are as follows: 1 Type 36 tube as Radio-frequency amplifier, 1 Type 36 tube as Detector-Oscillator, 1 Type 36 tube as intermediate frequency amplifier, 1 Type 85 tube as second detector and automatic volume control and audio-frequency amplifier, 1 Type 37 Tube as audio-frequency amplifier, 1 Type 79 tube for the output stage (Twin Power Class 'B').

Model B-6. This model is similar to Model 6 except that the receiver and dynamotor are installed in a metal box designed to be mounted in the car floor. The speaker is mounted on the dash and the control unit mounted on the steering column. This model was manufactured for the Chrysler Corporation for installation on Plymouth cars.

INSTALLATION:—Antenna. These sets are designed to operate with the conventional roof antenna installed in most closed cars. On cars with wooden top slats without antenna, a copper screen antenna can be installed or on cars with poultry wire reinforcement the poultry wire can be used for the antenna after it has been cleared of all grounds and trimmed back for a distance of three inches from all metal roof parts and from the dome light. The antenna lead-in should be shielded at least from the set to a point within the corner post of the car, and the shielding should be grounded.

Control Unit. The Control Unit for each of these sets is designed to be mounted on the steering post in a vertical or horizontal position and is furnished with a clamp band to be clamped on the steering column. When the set is installed the flexible volume control shaft and the tuning control shaft must be connected to the set. To connect the volume control shaft, fit the shaft in the sleeve on the upper left hand side of the front panel of the set (Models 7, 8, 12), push the shaft in until the tip is within the coupling on the volume control shaft and fasten the shaft casing by tightening the set screw on the bottom of the sleeve (inside the receiver); then, with volume control and switch knob turned off (counter-clockwise) and volume control in the same position, tighten the bottom set screw in the coupling, rotate the shaft in a clockwise direction and tighten the other two set screws. On the Models 6 and 9, take off the front cover plate on the set, see that volume control and switch are turned off both at control unit and receiver, connect the volume control shaft by tightening the set screws in the coupler and then tighten the set screw in the casing. To connect the tuning control shaft, turn the tuning dial to '55', see that the condensers



are fully meshed, insert the shaft in the coupler and tighten the set screws and then tighten the set screw in the casing. This setting can be checked by tuning in a station of known frequency and checking the dial reading. If setting is not correct, remove the face plate from the control housing, hold the tuning control stationary, lift the toothed edge of the scale over the teeth of the drive assembly and turn dial to the proper figure. Then allow dial to drop back in place so that teeth mesh with teeth on drive assembly.

Control Unit Pilot Light. The black wire on the Control Unit is the feed wire for the dial light. It should be connected to the Fahnestock binding post on the face of the receiver case.

Fuses. On the Models 7, 8, 12, where 'B' batteries are used, a one-ampere fuse is connected between the 'B—' battery terminal and the battery side of the ten-ampere 'A' supply fuse. Fuses are mounted in bakelite fuse clips screwed on the wooden hold-down on the batteries in the battery box. When sets are equipped with a Dynamotor a 15-ampere capacity fuse is connected in the 'A' battery supply lead (see paragraph on Dynamotor).

'B' Batteries. The use of dry batteries for the 'B' supply is optional on Models 7, 8, 12. Three 45-volt 'B' batteries, Philco No. P-302 (standard) or P-308 (heavy duty) are connected in series. The 'B—' terminal is connected through the one-ampere fuse mounted on the hold-down to the battery side of the ten-ampere 'A' supply fuse. The blue-white lead in the battery cable is connected to the 'B+135' battery terminal. The green-white lead should be connected to the 'B+67½' battery terminal. The black-white lead is the 'A' supply lead and should be connected to the 'A' fuse. For data on Dynamotor connections see paragraph on Dynamotor.

INTERFERENCE SUPPPRESSION:—The standard system of interference suppression requires the installation of a resistor on each spark plug and in the center terminal of the distributor cap, and connecting a condenser to the generator terminal of the cut-out relay and a second condenser to the battery terminal of the ignition coil. In most cases this eliminates practically all interference and has no effect on the performance of the car. The spark plug suppressors need not be used where 'radio' plugs are installed (with built-in resistors). These plugs are marked 'Radio'. On ignition systems with two ignition coils, a resistor should be installed in each coil high tension terminal on the distributor cap. The generator condenser should be mounted on the generator field frame (condenser is grounded through mounting bracket) and the lead should be connected to the generator side of the relay. The ignition condenser is likewise grounded through the mounting bracket and in mounting the condenser a good ground should be secured.

The ignition coil high tension lead should not be shielded. If interference is experienced all wiring should be removed from the vicinity of the high tension leads and they should be rearranged so as to be as short as possible. It is particularly important that the generator and horn leads should not be run through the spark plug cable conduit. A regular interference condenser can be connected across the dome light or to the ammeter when the standard installation does not eliminate interference. If all other means fail, the high tension lead on the lock switch type of ignition coil mounted on the instrument board can be shielded from a point near the coil to the dash by using standard shielded loom and grounding the shielding. The shielded portion of the cable should be kept as short as possible. This method should not be used until all other methods of eliminating interference have been tried.

ADJUSTMENT:—An Oscillator must be used to properly adjust the compensating condensers on these sets. Intermediate frequency on Models 7 and 8 is 175 kilocycles, and 260 kilocycles on Models 6 and 9. The Philco-Transitone Oscillator Model 095 can be used to produce signals of each frequency and should be used for all adjustments on compensating condensers.

DYNAMOTOR:—The Dynamotor consists of a small single unit motor-generator in a case which is designed to be mounted through a hole in the car floor. The Dynamotor must always be mounted horizontally with the case absolutely level as no provision is made for end thrust on the Dynamotor shaft. In connecting the Dynamotor the ground lead on the end of the terminal block must be connected to the 'A+' or 'A—' terminal on the block in accordance with the grounded terminal of the car battery. The 'A' supply lead from the car battery is connected to the other 'A' terminal on block corresponding to the ungrounded battery terminal. The Dynamotor case must always be grounded to the car frame through a heavy copper braid.

Installation Table

Receiver Type	Dynamotor Type
Model 3	EA (see note)
Model 7	EA (see note)
Model 6	EB
Model B-6	B6
Model 8	EA
Model 9	ED
Model B-9	EC
Model 12, Code 121	EC
Model 12, Code 122	EE

Dynamotor Data

Dynamotor Model	Input Voltage		Output		
Model EA	6.3	Volts	40	Milliamperes,	180 Volts
Model EB	6.3	"	40	"	180 "
Model EC	12.6	"	40	"	180 "
Model ED	6.3	"	40	"	220 "
Model EE	12.6	"	40	"	220 "

Model 3. When the Model EA Dynamotor is installed on the Model 3 receiver, originally equipped with dry cell batteries, the two resistors at the top of the Dynamotor terminal block must be removed. The ground lead from the filter condenser must be removed from the ground terminal and spliced so that it can be connected to the 'B+ Screen' terminal. The 'B—' lead (black) grounded at the rear of the Dynamotor case must be removed and likewise connected to the 'B+Screen' terminal, which becomes in effect the 'B—' terminal for the Dynamotor. The blue-white lead should be connected to the 'B+High Voltage' terminal, and the green-white lead to the 'B+Screen' terminal. A relay switch must be used to control the Dynamotor. Connections on the relay are as follows (looking at relay with mounting bracket toward observer): Connect middle terminal to car battery through 15-ampere capacity fuse, connect right hand terminal to 'A' terminal on Dynamotor corresponding to ungrounded battery terminal, connect left hand terminal to black-white lead in battery cable. Mount relay on car frame and connect ground lead on Dynamotor terminal block and cable shielding to remaining 'A' terminal on the block. Dynamotor case must be grounded to car frame through heavy copper braid.

Model 7. When Dynamotor is installed on Model 7 receivers, the blue lead must be connected to the 'B+High Voltage' terminal and the green lead to the 'B+Screen' terminal. The relay switch must be installed to control the Dynamotor. With relay positioned as above, make connections as follows: Connect terminal on side opposite bracket to the car battery through a 15-ampere capacity fuse, connect right hand terminal to 'A' terminal on Dynamotor terminal block corresponding to the ungrounded terminal of the car battery, connect the left hand terminal to the black-white lead of the battery cable. The ground lead on the Dynamotor terminal block and the cable shielding should be connected to the remaining 'A' terminal. Dynamotor case must be grounded to the car frame through a heavy copper braid.

Model 8. When the Dynamotor is installed on the Model 8, the two resistors on the top of the terminal block should be removed. The black-white lead in the cable should be connected to the 'A' terminal corresponding to the ungrounded terminal of the battery. The ground lead and the cable shielding should be connected to the remaining 'A' terminal. The blue lead should be connected to the 'B+High Voltage' terminal.

Model 12. The Dynamotor is connected in the same manner as the Model 8 except that the resistors are not removed.

AMERICAN BOSCH RADIO

"9:20" MODEL 100 SEVEN TUBE SET

DESCRIPTION:—The Model 100 motor car radio is a seven tube, superheterodyne circuit, automatic volume control set equipped with a dynamic speaker and designed to operate either with the conventional roof type antenna or a new type Bosch Capacitor Plate and Coupler. It may be used with the Bosch Magmotor or the usual dry-cell 'B' batteries (three 45 volt batteries are required). The tubes are all new types designed for automotive use and function as follows: one Type 236 tube as a radio frequency amplifier, one Type 237 tube as an oscillator, one Type 236 tube as the first detector, one Type 236 tube as an intermediate frequency amplifier, one Type 238 tube as diode-triode or second detector and audio-amplifier and to furnish voltage for automatic volume control, two Type 238 tubes as push-pull audio-amplifiers. The Type 238 tubes are 'pentode' power output tubes.

INSTALLATION:—The receiver case has two hooks which are designed to engage slots in the top of the mounting plate bolted to the dash under the cowl. The receiver can be mounted in any convenient position in the front compartment under the cowl so long as there is no interference with the car equipment. The set chassis is held in the receiver case by means of three screws located on top of the case. By loosening three screws, removing the bottom cover, removing the three holding screws, the case can be lifted off the chassis. The chassis can be reversed in the case (turned end for end) if desired in order to bring the control cable attachment to a more convenient location. To make this change it will only be necessary to remove the caps from the holes in the case provided for the new location of the holding screws. These caps should be transferred to the mounting holes which are not being used, as they serve to prvent the entrance of dust and water into the receiver.

Control Head and Cable. The Control Head is designed to be mounted on the steering column. When the head is installed it is necessary to adjust the position of the flexible drive cable for the particular installation. To connect the drive cable, proceed as follows: Slip the flexible cable housing and shaft into the bracket and coupling of the receiver, set the tuning dial at '100', then, facing the drive shaft end of the receiver, turn the drive shaft to the left or counter-clockwise as far as it will go, tighten the set screw in the drive shaft, tighten the set screw in the bracket. In tightening these set screws be careful not to damage the cable or casing.

Speaker. The two bolt holes for the speaker should be drilled on a vertical line whenever possible although they may be drilled horizontally when necessary. The speaker should be mounted solidly against the dash and any insulating material or lining on the dash should be cut away around the bolt holes so that the spacers seat solidly.

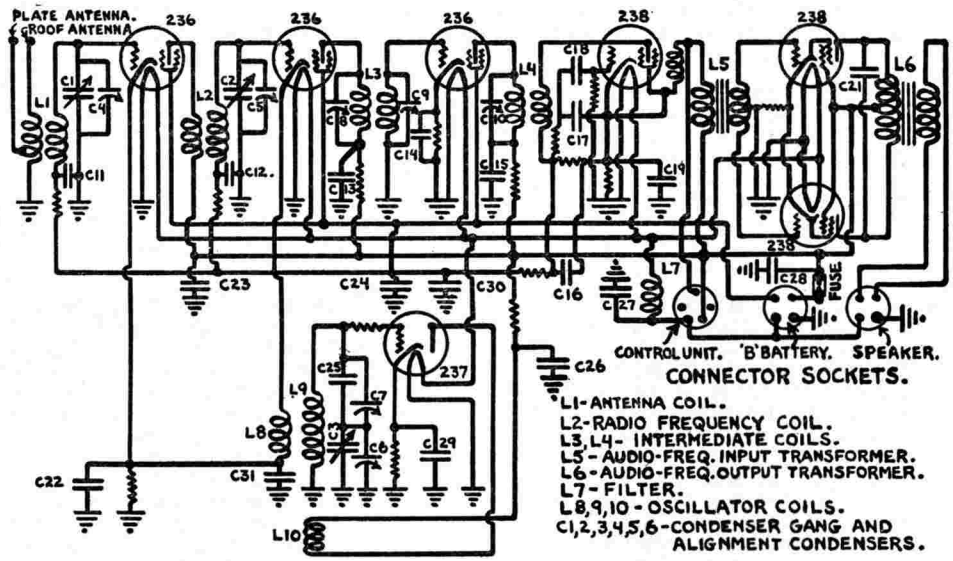
Battery Box and 'B' Batteries. The battery box is designed to be mounted through a hole in the floor boards and the top edge of the box is flanged to support the weight of the batteries. Batteries must be firmly wedged in place by means of corrugated spacers. The battery cable is provided with a plug which should be inserted in a socket on the receiver case. The three wires in the battery cables should be connected as follows: Black to 'B —', White to + 67½ volt terminal, Red to + 135 volt terminal (see illustration).

Magmotor. See the complete article on the Magmotor if this unit is used instead of the dry-cell 'B' batteries.

'A' Battery Connection. A special terminal clamp is provided which should be clamped on the battery cable as near the battery as possible (manufacturer recommends a location 1 inch from the battery terminal). The clamp has a pointed screw which should be turned down until it pierces the cable insulation and contacts the conductor. The 'A' battery cable should be connected to one of the clips of the 'A' battery fuse and the lead from the Control Head should be connected to the other fuse clip. After the fuse is assembled in the clips it should be covered by the special rubber protector.

A ground lead is provided in the Control Head cable. This lead is fitted with a large terminal which should be connected to the grounded terminal of the car battery.

Antenna. The set can be operated with the built-in antenna in the roof of the car or an antenna can be installed. On cars with wire mesh in the roof, this mesh may be used for the antenna provided that all grounds are removed and the wire mesh is cut back at least three inches from the metal portions of the car roof and from the dome light and dome light wiring. On cars with wooden slat roof construction a wire screen antenna may be installed. On cars with antenna installed the lead-in shielding must be grounded and must be cut back from the receiver lead splice. Whenever a built-in antenna is used this must be plugged into the socket on the set marked 'Antenna Jack' (see illustration).



Capacitor Plate and Coupler. The Capacitor Plate may be used instead of a built-in antenna if desired. The Capacitor Plate can be mounted at any convenient point under the car, however it should be mounted as near the rear as possible and extended to as great a length as is possible without interfering with any portion of the car. It should not be mounted near the engine to avoid ignition interference. The Capacitor Plate is provided with two mounting studs and clamps. The coupler is mounted on the front supporting bracket of the Capacitor Plate. The red lead of the coupler should be connected to the plate. The black lead should be spliced to the shielded antenna cable. The splice should be protected with rubber tape and the shielding kept back from the splice. When the plate is used the antenna lead-in should be plugged in the socket on the bottom of the receiver marked 'Plate Jack'.

Interference Suppressors. The usual spark plug suppressors are used. These must be installed on each spark plug and in the central terminal on the distributor cap. Spark plug suppressors are threaded on both ends and can usually be screwed directly on top of the plugs in a vertical position or may be installed horizontally, using the special angle bracket supplied. generator so that a good contact is provided between the condenser mount- The installation of the suppressors and the securing of a good connection between the suppressor and the conductor in the high tension cable is extremely important for car performance and good radio reception.

A by-pass condenser is also provided which should be mounted on the

ing lug and the generator frame. The condenser lead should be connected to the battery lead of the relay cut-out. In some cases better results may be secured by connecting the condenser lead to the generator terminal of the relay. The second condenser can be connected across any other device on the car which causes interference. In some cases it is connected from the ignition switch to ground to remove ignition interference.

ADJUSTMENT:—When the set is installed on the car an adjustment for maximum sensitivity and power must be made. To make this adjustment the car should be on the road, or at least outside the garage, and should not be touching any other object. Extension lights or portable drills with connecting cables should be removed from the car. Tune the receiver sharply to a station near the '15' point on the dial, selecting as weak a station as possible. Then turn the antenna adjustment nut until volume is at a maximum and the best reception is secured. The Bosch Service Tool No. 387 or a socket wrench can be used. If no station can be found at this position of the dial, the set can be adjusted for maximum sensitivity by bringing the noise level up to its highest point.

TESTING:—For all testing with the set on the car, a circuit tester consisting of a voltmeter and dry-cell battery connected in series with flexible leads ending in test points should be used. These tests are made by placing one test point on the terminal at one end of the circuit and touching the other test point to the other end of the circuit. A voltmeter equal to the battery voltage (this may be secured by touching the two test points together) indicates that the circuit between the two points is complete. If a high resistance resistor is included in the circuit, the voltmeter reading will be lower but some reading should be secured. No reading indicates an open circuit between the two points. In testing for grounds where one test point is touched to ground, no reading should be secured and a reading indicates that the circuit is grounded. If the set does not perform satisfactorily, check the following points:

1. 'A' Battery Supply. Connect voltmeter from lower fuse clip to ground. Voltmeter reading should be 6 volts with charged battery. If no reading is secured, battery cable is open or cable terminal is defective. Examine 'A' battery fuse. If fuse is blown do not replace until cause has been located and corrected. The control head dial will not be illuminated if the fuse is blown. If the dial is illuminated and set does not operate the switch in the Control Head must be checked.

2. 'B' Batteries. Check voltage of B batteries. Any battery reading less than 34 volts should be replaced. B battery voltage may be checked at the set by taking out the B battery cable plug and taking a voltmeter reading from the 'B—' prong of the plug to the '+135' prong. The reading should be between 135 and 102 volts and batteries should be tested individually and replaced if voltage is under 102 volts. There is a 1/16 ampere capacity B battery fuse mounted beside the terminal block under the receiver. Examine this fuse if batteries are satisfactory and set does not operate.

3. Magmotor (when used). The Magmotor output should be tested at the Magmotor with the cover removed. Voltage reading between blue and green cable terminals should be 90 volts. Voltage reading between blue and brown cable terminals should be 165 volts. Lower voltage readings indicate defective Magmotor or receiver. See separate article on Magmotor.

4. Control Head Switch. If the dial is illuminated and the set does not operate, a circuit test should be made between the upper 'A' fuse clip and the prong on the Control Head cable plug connected to the red wire in the cable. With the switch turned on, the voltmeter should indicate the full voltage reading of the test battery.

5. Antenna—Built-in or Roof Type. Disconnect antenna at the receiver and make a circuit test between the antenna terminal and ground. A reading indicates that the antenna or lead-in is grounded.

6. Capacitor Plate. Disconnect coupler lead at plate. Make a circuit test between Capacitor Plate and ground. A reading indicates that the plate is grounded.

7. Capacitor Plate Coupler. Disconnect both coupler leads. Make a circuit test across the coupler or between these two leads. Voltmeter should indicate full voltage of test battery. No reading indicates that the coupler is open. The entire antenna system may be quickly checked by disconnecting the antenna at the receiver and connecting a length of insulated wire to the antenna terminal on the set. The wire should be 15-20 feet in length and may be allowed to lie on the ground. If the reception of the set is improved, the antenna system is not satisfactory.

8. Speaker. A circuit test can be made between the large prongs of the speaker cable plug (field winding test) and also between the small prongs on the plug (voice coil test). Voltmeter should indicate full voltage of test battery in each case. Another speaker should be substituted for the one thought to be defective and the performance of the set compared.

9. Tubes. Tubes should be tested with an Analyzer. If this instrument is not available, a new tube should be substituted for the tube thought to be defective and the performance of the set noted. An improvement will indicate that the tube was defective. A defective oscillator tube may cause a high pitched whistle. This can be checked by substituting a new tube.

10. Wiring. See that all connections are tight, that all shielding is grounded and does not touch terminals or wires at splices, that 'B' batteries are properly connected, and that 'A' supply cable is properly attached to battery cable. Check interference suppressor system and see that all suppressors are in place and correctly installed and that by-pass condenser is connected as directed.

RECEIVER TESTING:—An Analyzer should be used in testing the receiver when tests made on the accessories as directed above does not locate trouble. The Analyzer permits a complete check to be made at the tube sockets and is much more satisfactory than other methods. In addition an Ohmmeter will be of great value in making circuit tests as it permits the determination of the resistance of the particular circuit being tested. The table of socket voltages given below is for use in making tests on the receiver with a Set Analyzer. The values are approximate and will be somewhat higher if the set is used in conjunction with a Magmotor.

Position	Tube	Filament	Cathode	Grid	Screen	Plate	Milliamperes
R.F.	236	5.8	.5	1.0	60	130	1.0
Osc.	237	5.8	3.0	8.0		130	3.0
Ist Det.	236	5.8	9.0	.5	55	120	1.0
I.F.	236	5.8	2.0	2.5	60	130	1.5
2nd Det.	238	5.8	5.0	.1	120	.1x	6.0x
Audio	238	5.8	12	12	135	130	10
Audio	238	5.8	12	12	135	130	10

NOTE:—The second detector tube is not connected in the usual manner (see diagram) since the plate voltage is applied to the screen and as a result the screen current is read instead of the plate current, as in the usual arrangement.

LOUD SPEAKER:—A rattle in the speaker may be caused by a wire touching the diaphragm, a loose part, or by the diaphragm being not properly centered. The speaker may be removed from the wooden case by taking out the screws holding the back in place. The moving coil must be exactly centered in the air gap. In replacing the diaphragm, this adjustment may be made by placing four strips .012" in thickness (paper or card may be used) in the space between the outside of the moving coil and the frame before tightening the screw holding the bronze diaphragm centering spring against the pole piece. In replacing the field magnet, the pole will be cor-

BOSCH MAGMOTOR

TYPE BD6-180, ED. 1

DESCRIPTION:—The Magmotor is a dynamotor designed to convert a 6-volt input current from the car battery to an 180-volt output direct current for use as the plate supply on automobile radio sets, thus eliminating the use of 'B' batteries. It was designed originally for use with the Model 100 or '9:20' American Bosch Radio Set.

The armature or rotating member of the Magmotor has a double winding and two distinct commutators. The 6-volt motor winding is connected to the 7-bar commutator and receives current from the car battery through two copper graphite brushes. The 180-volt generator winding is connected to a 14-bar commutator at the opposite end and delivers current through two high-resistance carbon brushes. The two pole field is energized by a permanent magnet and requires no field current.

The Magmotor is assembled in a case provided with mounting lugs and can be mounted at any convenient point on the car, provided only that the mounting is absolutely level so that all bearing thrust is eliminated. This is necessary in order to provide maximum efficiency of the unit. The power unit is insulated by rubber cushions and will operate without vibration and noise. All leads are grouped in a single cable fitted with a plug which connects with a socket on the receiver.

INSTALLATION:—Polarity. As furnished, the Magmotor connections are correct for installation on cars with the positive (+) terminal of the battery grounded. If the negative (—) terminal of the car battery is grounded, it will be necessary to reverse the polarity of the Magmotor before it is installed on the car. To make this change proceed as follows: first, remove the cover, disconnect the black (grounded) wire from the terminal clip on top of the Magmotor at the magnet end, disconnect the red (positive) wire from the terminal clip at the bottom of the Magmotor at the magnet end and reverse these two wires, that is, connect the red wire at the top and the black wire at the bottom. The supporting clip fastened to the red wire and fastened by the brush mounting screw should also be transferred. This is important as the clip is designed to prevent vibration and breakage of the red wire. The Magmotor may then be installed on the car.

SERVICING:—Lubrication of Bearings. The armature or rotor is mounted on ball bearings. In order to reduce friction, these bearings should not be lubricated with grease (they must be free from any trace of grease and spin freely). They should given 2 or 3 drops of special Bosch US506 oil once each year.

Adjustment of Bearings. Bearings are held in place by double set screws in the top of each endplate. The upper set screw acts as a lock for the lower or holding screw. In assembling the bearings, great care must be used in tightening these screws as excessive pressure will distort the bearing races and cause friction. The set screws should be tightened with the armature rotating and an ammeter in the circuit so that any friction caused by the distortion of the bearings can be noted by the resultant excessive current draw of the Magmotor.

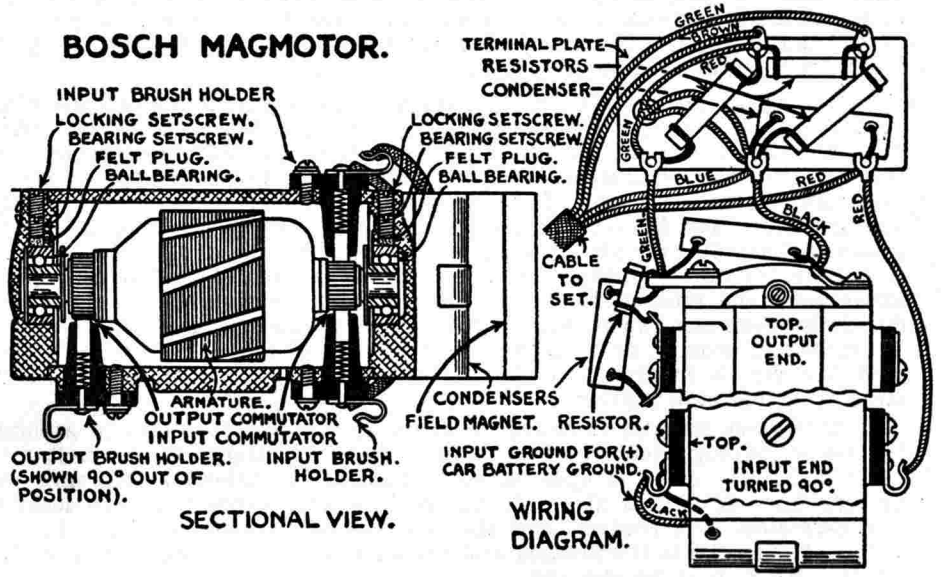
Brushes. Brushes are of special composition and must not be interchanged or replaced by any other than the correct type. The input end or motor brushes are copper-colored and can easily be distinguished from the carbon brushes used on the output end. The complete brush holder assembly should be replaced as a unit whenever new brushes are necessary.

Magnet. In service, the magnet should require remagnetizing only infrequently. However it should be remagnetized whenever work is done on the Magmotor and particularly when the armature has been removed

PERFORMANCE:—When the Magmotor is operating satisfactorily, the current input without load on the output side should be between .8 and 1.1 amperes maximum. With the filter system in circuit, the output should be not less than 160 volts with a load of 40 milliamperes and an input of 2.8 amperes maximum at 6 volts. Without the filter system, the output voltage should be 200 volts with load of 40 milliamperes with an input of 2.6-2.8

TESTING:—Tests on the Magmotor should be made with a voltmeter and single cell dry battery connected in series with flexible leads ending in test points. In making tests, the test points should be touched to the opposite ends of the circuit being tested and the voltmeter reading noted. If no reading is obtained the circuit is open (condensers should test 'open'.

In checking the Magmotor, first remove cover, examine all wires and connections, see that all wires are securely fastened to the correct terminals. If Magmotor operates, check output voltage by connecting voltmeter across output brush terminals. Voltmeter reading should be 200 volts. If output voltage is satisfactory, the circuits of the filter system should be tested with the circuit tester as directed in paragraph above. If output voltage is not satisfactory, check input voltage by connecting voltmeter across input brush terminals. Voltmeter reading should be 6 volts. If less than 5.5 volts, check for defective Magmotor cable or plug, open-circuit between



terminal strip and input brush holders, defective brushes, defective armature, excessive friction in bearings, wrong polarity, and loose or broken wiring. The polarity is very important as the Magmotor will revolve with input wires reversed but will not generate any output (see instructions on polarity connections in paragraph on "Installation').

If it is necessary to disassemble Magmotor for inspection, remove the unit from the car, remove the cover, disconnect green, black and red wires from terminals 2, 3, and 4, lift out the power unit. If further disassembly is necessary, place Magmotor on its side on the bench, unsolder condenser lead from top brush holder on input end, disconnect black and red wires from terminal clips on brush holders on input end, remove brush holders on both input and output ends. Then remove two upper ball bearing set screws, loosen the two lower set screws, withdraw four end plate fastening screws on filter end, carefully remove end plate and withdraw armature. In reassembling, use extreme care in adjusting bearings (see paragraph on 'Adjustment of Bearings), and see that all leads are connected to the correct terminals.

If brushes are worn, replace brush and holder as a unit and see that new brush holder is correctly installed and fastened in place. Commutators should be cleaned with gasoline and may be surfaced with fine sandpaper if necessary. The armature can be tested by means of a bar-to-bar test and growler test in the usual manner. The resistance of the armature is

1934 EQUIPMENT INDEX

AUTO-LITE TWO-CHARGE REGULATOR

TYPES TC-4100 (REGULATOR), TC-4200 (REGULATOR AND CUTOUT RELAY)
STANDARD EQUIPMENT ON 1934 HUDSON, HUPMOBILE 427, TERRAPLANE

DESCRIPTION:—The Two-Charge Regulator consists of a relay which cuts in a fixed resistance unit in series with the generator field when the generator voltage reaches the maximum for which the unit is set and cuts out this resistance when the generator voltage falls to the minimum for the which the unit is set. As generator voltage on third-brush control type generators rises as the battery becomes charged, the regulator provides a higher charging rate for a discharged battery and reduces the charging rate as the battery becomes charged. The resistor is a fixed unit and is merely cut in or out of the field circuit as the regulator contacts open and close. This provides two definite charging rates, the high rate being secured with the resistor shorted out of the field circuit (regulator contacts closed), and the lower rate with the resistor in series with the field coils (regulator contacts open).

OPERATION:—When the generator voltage reaches the maximum for which the unit is set, the current flow through the shunt winding of the regulator opens the regulator contacts cutting the resistance in the field circuit (resistor unit is connected across the contacts and is short-circuited when the contacts are closed). The anti-flutter winding (second coil winding) also comes into action when the contacts open. The contacts remain open until the generator voltage falls to the minimum for which the unit is set and then close, shorting out the resistance so that the higher charging rate is resumed. A bi-metal spring support extension on the armature compensates the regulator for temperature variations.

PERFORMANCE AND ADJUSTMENT:—Regulator should perform in accordance with this table:

Voltage at which Regulator Contacts Open				Voltage at which Regulator Contacts Close		
Low Limit	Setting	High Limit	Temp.	Low Limit	Setting	High Limit
8.70	8.90	9.20	0°F.	6.90	7.10	7.30
8.64	8.84	9.13	10	6.84	7.04	7.24
8.58	8.78	9.05	20	6.78	6.98	7.18
8.51	8.71	8.98	30	6.71	6.91	7.11
8.45	8.65	8.90	40	6.65	6.85	7.05
8.39	8.59	8.83	50	6.59	6.79	6.99
8.33	8.53	8.75	60	6.52	6.72	6.92
8.26	8.46	8.68	70	6.46	6.66	6.86
8.20	8.40	8.60	80	6.40	6.60	6.80
8.14	8.34	8.55	90	6.35	6.56	6.76
8.08	8.28	8.50	100	6.30	6.52	6.72
8.02	8.22	8.45	110	6.25	6.48	6.68
7.96	8.16	8.40	120	6.20	6.44	6.64
7.90	8.10	8.35	130	6.15	6.40	6.60
7.85	8.05	8.30	140	6.10	6.36	6.56
7.79	7.99	8.25	150	6.05	6.32	6.52
7.73	7.93	8.20	160	6.00	6.28	6.48
7.67	7.87	8.15	170	5.95	6.24	6.44
7.61	7.81	8.10	180	5.90	6.20	6.40
7.55	7.75	8.05	190	5.85	6.16	6.36
7.49	7.69	8.00	200	5.80	6.12	6.32

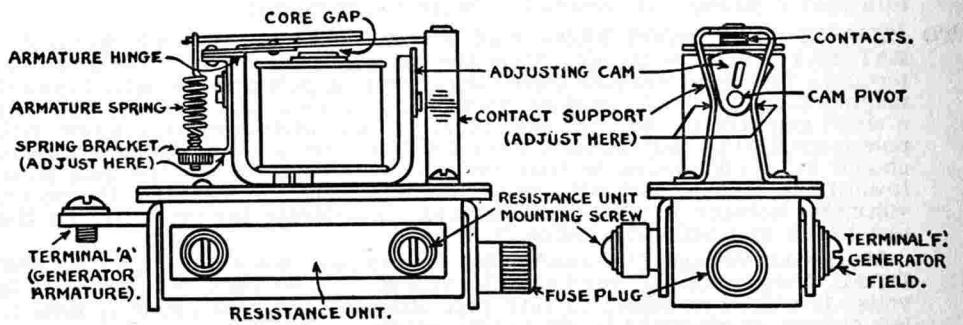
Regulators should be carefully tested (with full allowance being made for air temperature) before adjustments are made. See test procedure below. The manufacturers recommends that units which test defective or out of adjustment be replaced rather than adjusted or repaired in the field. Adjustment instructions are as follows:

(1) **Contact point opening (from high to low charging rate).** Adjust armature spring tension by bending the lower spring bracket (see illustration). Do not unsolder nut, any necessary adjustment can be made by bending the spring bracket. Be careful not to distort the bronze armature hinge. Distortion of hinge will cause unsatisfactory regulator operation. Check performance after adjusting.

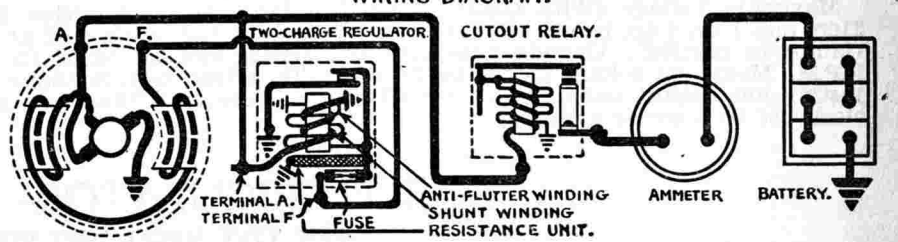
(2) **Contact point closing (from low to high charging rate).** Adjust brass cam, which acts as armature stop and controls contact gap (see illustration). After completing adjustment, apply a small amount of air-drying varnish to cam to prevent it slipping in service. Check performance after adjusting.

TESTING:—On the car. Connect a variable resistance in charging line to control generator voltage. Test voltmeter should read and be accurate to within .1 volt. Before test is made, car should stand in room with uniform temperature for at least one hour. Check air temperature when test is made, by thermometer placed about one inch from regulator. Regulator cover must be in place while testing. Regulator should perform in accordance with figures given in Performance Section above.

Bench Testing. Regulator should preferably be tested on bench. Connect voltmeter between terminal 'A' on regulator and ground. Ground one terminal of a 12 volt battery. Connect the other battery terminal to one side of a variable resistance and ground the other resistance terminal. Connect the sliding contact of the resistance to the 'A' regulator terminal. Connect a 32 cp. 6 volt lamp between the 'F' regulator terminal and a center tap on the battery (supplying 6 volts). Regulator action can now be checked by varying battery voltage by means of the variable resistance. Observe all temperature precautions noted in paragraph above. Resistance unit for this test should be 12 volts, 48-50 ohm type.



WIRING DIAGRAM.



SPECIFICATIONS:—Contact Gap—.005″ minimum. See contact point closing adjustment above.

Core Gap:—.030″ plus or minus .001″ with contacts closed. Adjusted by expanding or contracting upper contact support bridge. If core gap is greater than specified, the temperature compensation feature is increased. If core gap is less than specified, the contacts tend to open at lower voltages with extreme temperatures and performance will not be as noted in performance table.

Resistance Unit:—Resistance units are furnished in following standard sizes:

Resistance	Marking	Part No.
1.85-2.10 ohms	1.85	TC-51
.90-1.1 "	1	TC-51A
2.75-2.95 "	2.85	TC-51B

Coils:—Shunt winding should test 44-50 ohms (between generator 'A' terminal and ground). Anti-flutter winding should test 36-40 ohms (between field 'F' terminal and ground with contacts open and resistance unit disconnected.

NOTE:—When regulator is mounted on car in any other location than on generator field frame, the armature should be vertical (viewed along length). Excessive vibration should be avoided. Regulator is grounded through mounting and a good ground should be provided (remove paint and grease from under mounting lugs).

BOSCH GENERATORS

TYPES RJ75/6-900, RJA75/6-900, RJB75/6-900 (WITH AND WITHOUT BATTERY)

DESCRIPTION:—These generators have been furnished for use with battery or without battery where genrator is used for lighting only on tractors, etc. They may be changed over from one type of service to the other by following the directions given below. See separate articles for illustration of generator and regulator and complete description and adjustment of the regulator used with these generators.

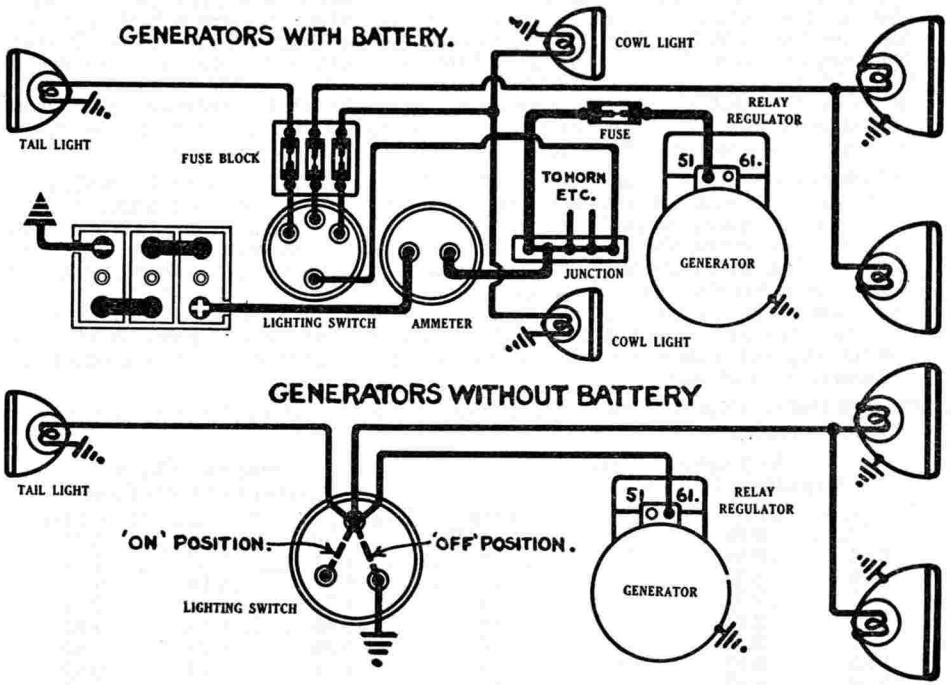
TO CHANGE GENERATOR FROM USE WITHOUT BATTERY TO USE WITH BATTERY:—Remove the plug from the cable hole for terminal '51' and plug terminal '61'. Bend the pole piece stop outward until gap between pole piece and magnet core is 3-3.2 MM. or .118-.126" with pole piece against stop. This will allow relay cutout contacts to open. Check relay contact gap. With the pole piece stop in correct position, relay contact gap should be .3-.5 MM. or .012-.020". Adjust regulator as directed in article on Bosch Regulators (Generators With Battery). Follow the complete adjustment procedure—Regulating Voltage (No Load), Regulating Voltage (With Load), Cut-in Voltage, Reverse Current, and final load test. When generator is installed, make certain that negative (—) terminal of battery is grounded.

TO CHANGE GENERATOR FROM USE WITH BATTERY TO USE WITHOUT BATTERY:—Remove the plug from the cable hole for terminal '61' and plug terminal '51'. Bend the pole piece stop in so that pole piece is moved toward magnet core sufficiently to close cutout relay contacts permanently. See that a small gap remains between pole piece pin and reverse current screw with pole piece against stop so that lower regulator contacts are closed. The gap should be small enough so that the slightest movement of the pole piece toward the magnet core will open the lower regulator contacts. Connect a voltmeter between terminal '61' and ground. Operate the generator on the test bench and make the following tests.

Maximum Voltage (No Load). Slowly increase generator speed to 3600 R.P.M. Note voltmeter readings. Maximum voltage must not exceed 6.75 volts. It will be necessary to turn regulator adjusting nut about ½ turn to left or counter-clockwise to secure this setting.

Maximum Voltage (With Load). Connect a lamp load comprising 2 6v. 21cp. and 1 6v. 4 cp. lamps (34 watt total) between terminal '61' and ground (lamps in parallel). Operate generator and slowly increase speed to 3600 R.P.M. Maximum voltage should be 6.5 volts. To adjust, turn regulator adjusting nut slightly out or counter-clockwise to decrease voltage, and in or clockwise to increase voltage.

Final Load Test. After completing load test, operate generator for one-half hour at 2000 R.P.M. with this same load (34 watts). Repeat tests for maximum voltage (no load), and maximum voltage (with load). Readjust as necessary. If readjustments have been made, repeat final load test.



BOSCH REGULATOR—GENERATORS WITH BATTERY

NEW TYPE SINGLE UNIT VOLTAGE REGULATOR AND CUTOUT RELAY

DESCRIPTION:—This type unit is a combined cutout relay and voltage regulator using only one coil (see illustration). The unit is mounted on top of the generator or inside the commutator end cover. Types used on particular generators are as follows:

Voltage Regulator Type	Generator Types
SSM-11/1	RE
SSM-6/1, SSM-6/11, SSM-6/15	RJ & RJA
SSM-11/1, SSM-11/15	RJB
SSM-23/2	RJC
SSM-11/14, SSM-11/17	RK
SSM-23/10	RKC-130/6
SSM-23/44, SSM-23/5	RKC 130/12

ROTATION:—With field connections as shown in illustration (red field coil lead) connected near red arrow, generator rotation is clockwise as viewed from commutator end. To reverse direction of rotation, disconnect and exchange red and blue field coil leads. The battery used with these generators must always have the negative (—) terminal grounded. On Types RJ and RJA generators, terminal 'H' is located in place of terminal 'F' and terminal 'F' is located near regulator adjusting nut. On Types RJC and RKC generators, the leads for the field coil and field resistance are not connected to terminals 'H' and 'F' but are connected to the positive brush and to an insulated bar inside the commutator end plate. The red and blue arrows are stamped into the commutator end plate. When the red field coil lead is connected near the arrows, the generator rotation is clockwise as viewed from the drive end. To reverse the direction of rotation, disconnect and exchange the red and blue field coil leads.

OPERATION:—The illustration shows the position of the regulator with the generator not running (cutout contacts open, lower regulator contacts closed, upper regulator contacts open). In this position the generator field resistance (wound on one field pole) is short-circuited. When the generator is operated, the generator current flows through the current or 'series' winding and then through the voltage or shunt winding. When the cut-in point is reached the magnetic field created by this current flow is sufficient to attract the pole piece, closing the cut-out contacts so that the generator current flows to terminal '51' and to the battery.

As the generator voltage rises, the movement of the pole piece toward the coil core first opens the lower regulator contacts which cuts the field resistance in series with the generator field. If the voltage continues to rise, the pole piece then closes the upper regulator contacts which momentarily short-circuits the generator field. This action results in maintaining an even voltage for all generator speeds.

ADJUSTMENT:—If generator performance is not satisfactory, check the following points before removing generator from the car:

1. Generator Drive. See that generator is properly driven without belt slippage, etc.

BOSCH REGULATOR—GENERATORS WITH BATTERY

NEW TYPE SINGLE UNIT VOLTAGE REGULATOR AND CUTOUT RELAY

2. Wiring. Examine wiring, see that all connections are clean and tight (see illustration). Look for possible short-circuits.

3. Commutator and Brushes. See that brushes are not worn and that they are properly fitted. Examine commutator, clean if necessary.

Generator should be removed to the test bench and operated with regulator disconnected to make certain that regulator unit is at fault. To make this test, disconnect current winding lead from terminal 'H' and ground terminal 'F'. Operate the generator at speed shown in the following table and note whether voltage is within limits indicated. If voltage is not correct, examine generator for correct rotation, defective brushes, armature or field coils burnt out, or open connections.

Generator Type	Operating R.P.M.	Voltage Limits
RE	1600 R.P.M.	6-9 volts
RJ, RJA, RJB-75/6-900	850	6-9
RJC-90/6-1100	1100	6-9
RK-100/12-700	640	12-17
RK-130/12-900	750	12-17
RKC-130/6-1000	1000	6-9
RKC-130/12-825	825	12-17

If this test indicates that generator performance is satisfactory, reconnect regulator and test as follows. The entire test procedure as outlined below should be followed out before any readjustments are made. Before testing, examine relay and regulator contacts. If contacts are worn or pitted, clean and resurface contacts without disassembling. Relay contact gap should be .3 MM. (.012").

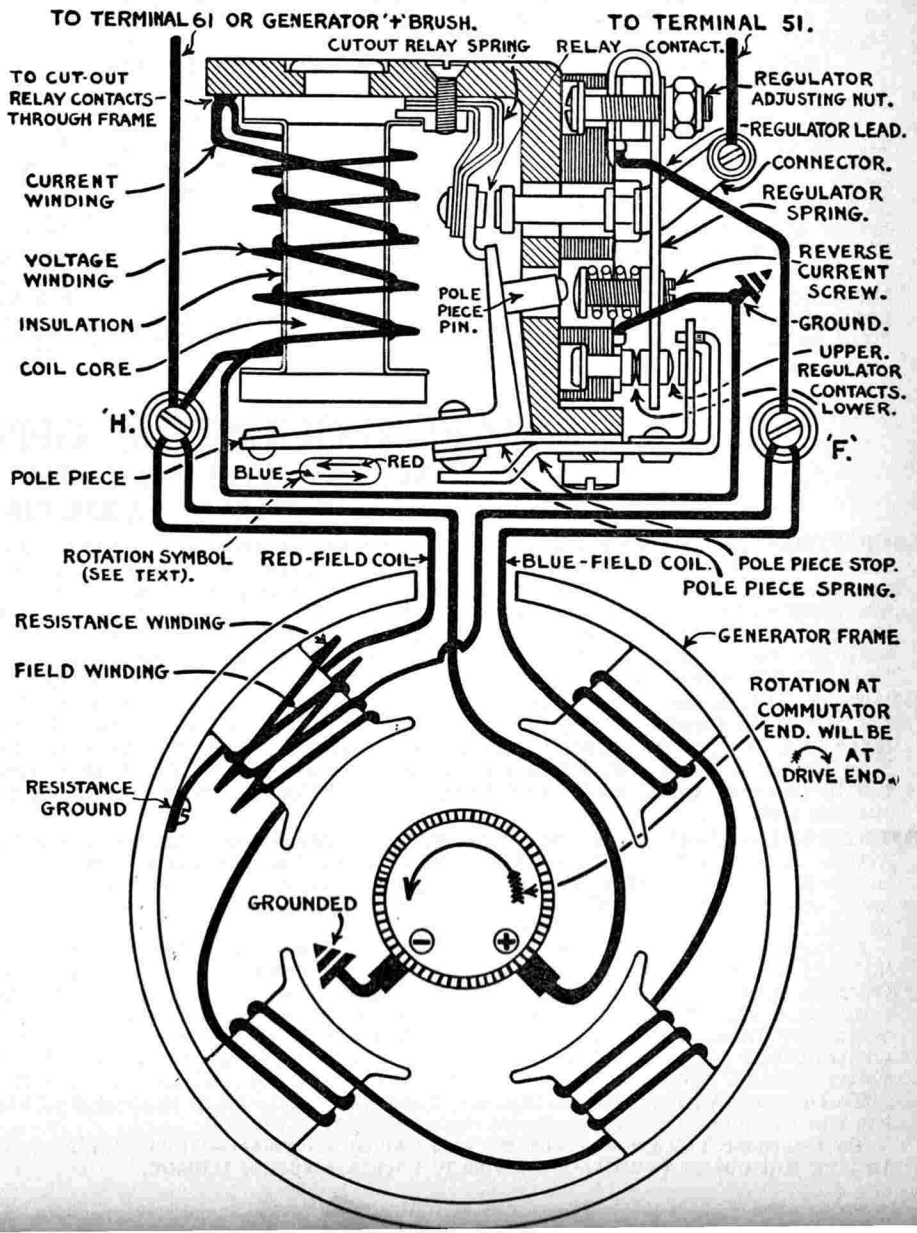
1. Regulating Voltage (No Load). Connect a voltmeter between terminal '61' and ground (if terminal 61 is plugged, connect voltmeter to stud 'H' or insulated brush. Operate the generator without load at 'nominal' speed given in table below. Note voltmeter reading. Then increase generator speed to 'maximum' and note voltmeter reading. Maximum voltage readings as recorded during this period while generator speed is increased to maximum point must be within limits given in the table and the voltage reading at maximum speed must not be more than .5 volts above or .2 volts below the voltage at nominal speed. To adjust, turn regulator adjusting nut to left (counter-clockwise) if regulating voltage is too high, or to the right (clockwise) if regulating voltage is too low. If correct regulating vontage cannot be secured with this adjustment, the regulator unit should be replaced.

Generator Type	Nominal Speed	Maximum Speed	Regulating Voltage
RE	1700 R.P.M.	5000 R.P.M.	7.3-8.5 volts
RJ, RJA, RJB	900	3500	7.3-8.5
RJC-90/6-1100	1100	4500	7.3-8.5
RK-100/12-700	700	3600	14.3-16.8
RK-130/12-900	900	3600	14.3-16.8
RKC-130/6-1000	1000	3600	7.3-8.5
RKC-130/12-825	825	4500	14.3-16.8

2. Regulating Voltage (With Load). If perforformance without load (Test 1) is satisfactory, this test can be omitted or may be made as a check on the results secured in the no-load test. Connect a voltmeter between terminal '51' and ground. Connect a lamp load of size indicated in table below between this same terminal and ground (lamps to be connected in parallel). Disconnect field lead on stud 'H', connect this lead to one terminal of an ammeter and connect the other ammeter terminal to the stud (placing ammeter in series with field to read field current). Operate generator and slowly increase speed until ammeter reading suddenly drops to about 1 ampere. This indicates that lower regulator contacts have opened and the voltmeter reading at this point is known as the 'lower regulating voltage'. Voltage readings must be within limits given in table below. To adjust, turn regulator adjusting nut to right (clockwise) if lower regulating voltage is too low, or to the left (counter-clockwise) if lower regulating voltage is too high.

As generator speed increases the upper regulator contacts finally close, short-circuiting the field winding (ammeter pointer will drop to '0'). The voltmeter reading at this point is known as the 'upper regulating voltage'. It must be within .5 volts above or .2 volts below the lower regulating voltage. If correct regulating voltage cannot be secured with this adjustment, the

Generator Type	Load Watts	Load No. & Cp. Lamps	Lower Regulating Voltage	Maximum Speed
RE	60	4-6v.-21cp.	6.7- 7.2 volts	5000 R.P.M.
RJ, RJA, RJB	75	5-6v.-21cp.	6.7- 7.2	3600
RJC-90/6-1100	90	6-6v.-21cp.	6.7- 7.2	4500
RK-100/12-700	100	7-12v.-21cp.	12.9-14.1	3600
RK-130/12-900	130	9-12v.-21cp.	12.9-14.1	3600
RKC-130/6-1000	130	9-6v.-21cp.	6.7- 7.2	3600
RKC-130/12-825	130	9-12v.-21cp.	12.9-14.1	4500



BOSCH REGULATOR—GENERATORS WITH BATTERY

NEW TYPE SINGLE UNIT VOLTAGE REGULATOR AND CUTOUT RELAY

3. Cut-in Voltage. Connect a voltmeter between terminal '61' and ground or between insulated brush and ground. Operate generator and slowly increase speed. Note voltmeter reading at instant relay contacts close (pole piece will move toward magnet core and can be easily noted). Voltmeter reading (cut-in voltage) must be within 6 and 9 volts for 6 volt generators (see tables above), or 12 and 17 volts for 12 volt generators. To adjust, bend pole piece stop (see luustration) slightly outward or away from pole piece to increase cut-in voltage, or in toward pole piece to lower cut-in voltage. On first type regulators the pole piece stop is located at the lower end of the pole piece instead of as shown. When making this adjustment, see that relay contact gap and pole piece gap (between pole piece and magnet core) does not exceed limits in table below. If correct adjustment cannot be secured wihout exceeding these contact gap and pole piece gap limits, replace regulator unit.

Relay Contact Gap Limits ..... .3- .5 MM. or .012-.020″
Pole Piece Gap Limits ..... 3-3.2 MM. or .118-.126″

4. Reverse (Cut-out) Current. Depress the pole piece until the lower regulating contacts are about to open, measure distance from pole piece to relay contact spring angle (point of contact between pole piece and contact spring when contacts open). This distance must be within limits of .2-.4 MM. or .008-.016″. To adjust, turn the reverse current screw in or clockwise to decrease this distance, and out or counter-clockwise to increase this distance. Then connect a voltmeter between terminal '51' and ground and an ammeter between terminal '51' and the positive (+) terminal of a battery. Ground the negative (—) terminal of the battery. Use a 6 volt battery for 6 volt generators and 12 volt battery for 12 volt generators. Battery must have sufficient capacity to show a voltage of 6.1-6.2 volts (6 volt battery), or 12.2-12.4 volts (12 volt battery) with a 6 ampere discharge. Operate the generator at a speed sufficient to charge the battery (relay contacts closed). Slowly decrease generator speed until ammeter reading drops to '0' and then shows a discharge or reverse current. Note ammeter reading when contacts open (ammeter pointer will drop to '0' at this point). Maximum reverse current as shown on ammeter must be within limits of 3-6.5 amperes. To adjust, turn reverse current screw in (clockwise) to decrease reverse current, and out or counter-clockwise to increase reverse current. Do not attempt to bend relay contact spring.

FINAL LOAD TEST (AFTER ADJUSTING):—After adjusting regulator, generator must be given a final load test to determine regulator action in service. Connect a lamp load as given in table below between terminal '51' and ground (lamps connected in parallel). Operate the generator for at least 15 minutes at speed given in table. Then allow generator to cool off to room temperature, repeat tests given above (regulating voltage without load, regulating voltage with load, cut-in voltage, reverse current), readjust as necessary. If readjustment is necessary, repeat the final load test.

Generator Type	Watts	Lamp Load No. & Cp. Lamps	Operating Speed
RE	60	4- 6v.-21cp.	4000 R.P.M.
RJ, RJA, RJB	75	5- 6v.-21cp.	3000
RJC-90/6-1100	90	6- 6v.-21cp.	3500
RK-100/12-700	100	7-12v.-21cp.	2500
RK-130/12-900	130	9-12v.-21cp.	3000
RKC-130/6-1000	130	9- 6v.-21cp.	3000
RKC-130/12-825	130	9-12v.-21cp.	3000

BOSCH REGULATOR—GENERATORS WITHOUT BATTERY

NEW TYPE SINGLE UNIT VOLTAGE REGULATOR AND CUTOUT RELAY AS USED ON TYPES RE, RJ, RJA, RJB GENERATORS (WITHOUT BATTERY)

DESCRIPTION:—This type regulator is the same as the type used on these generators with battery (see previous article). The generators are changed over for use without battery principally by having the pole piece stop bent so that the relay cutout contacts are permanently closed although a small gap must be normally found between the pole piece and the reverse current screw with the pole piece against the stop. See special article for complete directions for changing these generators over for use with or without battery.

ROTATION:—With field connections as shown in illustration (red field coil lead connected to terminal 'H'), generator rotation is clockwise as viewed from drive end. To reverse direction of rotation, disconnect and exchange red and blue field coil leads. On Types RJ and RJA generators, terminal 'H' is located in place of terminal 'F" and terminal 'F" is located near regulating adjusting nut.

ADJUSTMENT:—Check generator, drive, wiring, commutator, etc., as directed in article on generators with battery, before removing generator from car. If preliminary test on test bench indicates that regulator performance is unsatisfactory or that regulator is out of adjustment, make the following tests in order before readjustments are made.

1. Regulating Voltage (No Load). Connect a voltmeter between terminal '61' and ground (these generators will normally have terminal '51' plugged). Operate generator at 'nominal' speed and observe voltmeter reading. Voltage must be 6 volts or more. Then increase speed to 'maximum' speed and note voltmeter readings while speed is being increased. Voltage must be held within limits indicated. See table below for 'nominal', 'maximum' speeds and voltage limits. If generator voltage is not within limits, adjust as follows:

To Increase Voltage (maximum less than 6.6 volts)—Turn regulator adjusting nut in or clockwise to increase regulator spring tension.

To Decrease Voltage (maximum more than 7.4 volts)—Turn regulator adjusting nut out or counter-clockwise to decrease spring tension.

Generator Type	Nominal Speed	Maximum Speed	Voltage Limits
RE	1600 R.P.M.	5000 R.P.M.	6.6-7.4 volts
RJ, RJA, RJB	850	3600	6.6-7.4

2. Regulating Voltage (With Load). Connect a voltmeter between terminal '61' and ground. Connect a load comprising 2 6v. 21cp. and 1 6v. 4cp. lamps (34 watts total) between terminal '61' and ground (lamps in parallel). Operate generator and slowly increase speed to maximum as given in table below. Generator voltage must be within limits as shown. If voltage is not within these limits, adjust as follows:

To increase Voltage (maximum less than 6.4 volts)—Turn regulator adjusting nut in or clockwise to increase regulator spring tension.

To Decrease Voltage (maximum more than 6.6 volts)—Turn regulator adjusting nut out or counter-clockwise to decrease spring tension.

Generator Type	Maximum Speed	Voltage Limits
RE	5000 R.P.M.	6.4-6.6 volts
RJ, RJA, RJB	3600	6.4-6.6

NOTE:—Since the relay cutout contacts are permanently closed, it is not necessary to make a cut-in and cut-out test as on generators used with battery.

FINAL LOAD TEST (AFTER ADJUSTING):—After adjusting regulator, generator must be given a final load test to determine regulator action in service. Connect a load comprising 2 6v. 21cp. and 1 6v. 4cp. lamps (34 watts total) between terminal '61' and ground (lamps must be in parallel). Operate the generator for at least 15 minutes at the speed given in the table below. Allow generator to cool down to room temperature and check regulating voltage without load and regulating voltage with load as directed above, readjust as necessary. If any readjustment is found necessary, repeat final load test.

DELCO-REMY LAMP LOAD TYPE GENERATORS

Lamp load type generators are designed to produce a varied or stepped output, with a greater output when the car lights (lamp load) are turned on, so that the charging rate to the battery is not subject to as great a variation as is the case with convenional third brush control type generators. Three distinct types have been developed and are in use.

LIGHT SWITCH CONTROLLED FIELD RESISTANCE TYPE

(See Car Pages for Illustration.)

DESCRIPTION:—This type generator has a resistance unit in series with the generator field. The resistance unit is mounted on the lighting switch and is in series with the field coils with the switch turned 'off' or in the 'Park' position. When the switch is operated to turn on the headlights (principal lamp load), the resistance is shorted out, decreasing the total field resistance, and increasing the generator output.

PERFORMANCE:—There are two distinct charging rates, the lower charging rate for day driving (lights turned off—resistance in circuit), and the higher charging rate for night driving (lights turned on—resistance shorted out). The generator used for this type installation is a conventional third brush control type, the lighting switch being used as a convenient method of switching the field resistance in or out of the field circuit. See car data sheets for performance data on particular generator models.

ADJUSTMENT:—Charging rate is adjusted in usual manner by shifting the third brush. Field resistance must be shorted out while adjustment is being made (ground field terminal on generator to generator field frame). Shift third brush in direction of armature rotation to increase charging rate and in opposite direction to decrease charging rate. See car data sheets for instructions and performance data on each generator model.

FIELD RESISTANCE:—All generators are regularly equipped with 1 ohm field resistance unit (on lighting switch). This is standard for average driving conditions (day and night, high and low speed). If car is operated in service with other than average driving conditions, make adjustments as noted below:

Excessive Day Use—Battery Overcharged:—Change resistance to 1½ ohm unit or reduce charging rate (third brush setting).

Excessive Night Use—Battery Undercharged:—Change resistance to ½ or ¾ ohm unit, check charging rate (do not set third brush beyond rated capacity of generator—see performance data on car data sheets for maximum setting).

Replacement resistance units are standard Delco-Remy thermostat resistance units. Parts numbers are as follows:

Resistance	Part No.
½ ohm	807180
¾ "	817911
1½ "	808767

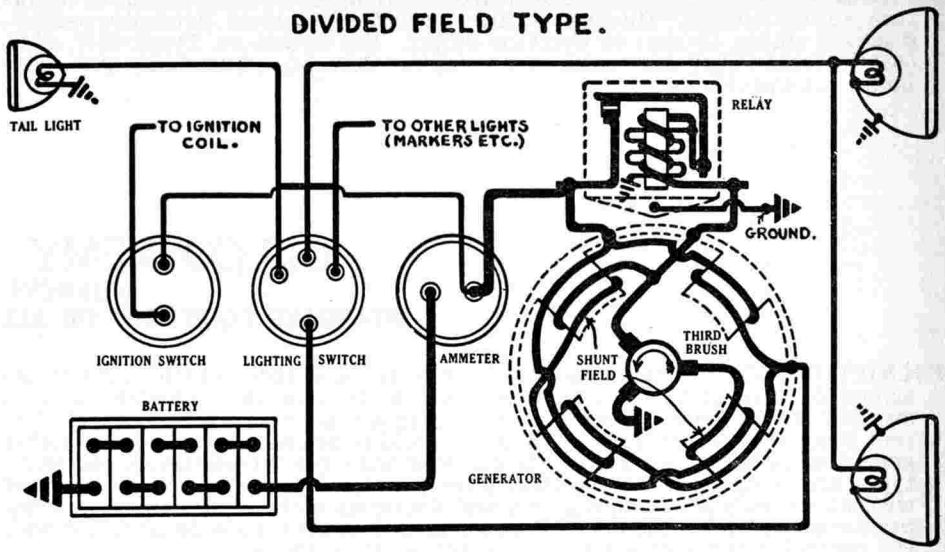
DIVIDED FIELD TYPE

DESCRIPTION:—This type generator is a four pole unit with a conventional third brush controlled shunt field wound on two opposite field poles. A second winding on the other two field poles is connected in series with the lamp load (lamps are connected to special terminal on generator—see diagram). With all lamps off, generator operates as a regular third brush control type, all of the field excitation being supplied by the two third brush field coils, the field being of the 'consequent' or alternately excited pole type. When the lamps are turned on, the lamp current flows through the other two coils, strengthening the field and increasing the generator output.

PERFORMANCE:—Generators of this type are designed for a definite maximum lamp load and the 'lamp load' figure in table below must not be exceeded (check lamp load with all lamps turned on by connecting ammeter in lamp circuit at terminal 'L'). Generators should not be operated with all load connected to ammeter terminal, since the stepped or two stage charging rate is secured only with lamp load connected to generator terminal 'L'.

Generator Model	Maximum LampLoad—Amperes
434	20
438	13
552	20
970-A	20
SM-1211	13
SM-1268	20

DIVIDED FIELD TYPE.



ADJUSTMENT:—Charging rate adjusted in usual manner by shifting third brush. Connect test ammeter between generator terminal and cut-out relay (do not connect ammeter to battery side of relay as ammeter will not register any current flowing to lamp circuits). Shift third brush in direction of armature rotation to increase charging rate, and in opposite direction to decrease charging rate. Charging rate should be set in accordance with operating conditions of car—performance table given below is maximum output, which must not be exceeded.

Performance Data—No Lamp Load

Cold Test			Generator	Hot Test		
Amperes	Volts	R.P.M.		Amperes	Volts	R.P.M.
10-12	7.45-7.65	2000	434	6-8	7.05-7.35	2100
7.0	14.2	2100	438	4.6	13.7	2300
10-12	7.45-7.65	2000	552	6-8	7.05-7.35	2100
15-17	7.9-8.1	1500	970-A	11-13	7.45-7.65	1600
7.0	14.2	2100	SM1211	4.6	13.7	2300
15-17	7.9-8.1	1500	SM1268	11-13	7.45-7.65	1600

FUSE:—A 20 ampere capacity fuse is connected in the lamp circuit to protect the generator from excessive lamp load.

CURRENT REGULATED SHUNT TYPE

DESCRIPTION:—This type generator is shunt wound, no third brush being used. An external current regulator is used to regulate the generator output. The feed wire or lead for the lamps is taken from the current regulator so that the lamp current does not flow through the entire current regulator winding (one coil only instead of both coils). This has the effect of increasing the generator output by an amount equal to one-half the lamp load when the lamps are turned on.

PERFORMANCE:—Generators of this type are designed for a definite maximum lamp load and lamp load figure in table below must not be exceeded (check lamp load with all lamps turned on by connecting ammeter in lamp circuit at terminal 'L').

Generator Model	Control Unit	Max. Lamp Load—Amperes
933-B, C	5541	11
933-D	5543	7
5030591	5545	7
961-C	5541	11

DELCO-REMY LAMP LOAD TYPE GENERATORS

ADJUSTMENT:—Charging rate is adjusted by changing current regulator armature spring tension. Increase spring tension to increase generator output, decrease spring tension to decrease output. See article on Types 5541, 5543, 5545 Current Regulators below for complete data on adjustment, and maximum generator output.

LIGHTING THERMOSTAT:—A thermostatic arm type current limit relay (no winding) mounted in the Control Unit is used to protect the lighting circuits from overload. Thermostat contacts open with lamp load of 20 amperes wih temperature of 210°F. (air—thermostatic arm temperature 375-385°F.).

DELCO-REMY CONTROL UNITS

CURRENT REGULATOR TYPE

STANDARD EQUIPMENT ON ALL CADILLAC AND LA SALLE MODELS

DESCRIPTION:—The Current Regulator used in these type control units is designed to control the generator output. It is used in connection with a straight shunt wound generator (see separate article on 'Lamp Control Current Regulated Shunt Type Generators') and is designed to provide a higher generator output when the car is operated with the lamps turned on. Some types are compensated for temperature variations and the output increases with abnormally low temperatures and decreases with abnormally high temperatures (see table below). All compensated types should be adjusted with the control unit warmed up to room temperature (70°F.).

OPERATION:—The entire generator output from the cutout relay is fed through the two coil windings of the Current Regulator (with lamps off). When the output reaches the maximum figure for which the unit is set, the Regulator contacts open (or vibrate), cutting the resistance unit which is connected across the contacts in series with the field current and holding the output constant. The car lamps are connected to a lead which is taken off on the battery side of the first regulator coil (see illustration) so that the lamp current does not flow through both coils (one coil insead of two). When the lamps are turned on this has the effect of reducing the magnetic field of the Regulator coils since a portion of the generator output is shunted by the second regulator coil. This increases the generator output by an amount equal to one half the lamp load and results in a more even charging rate to the battery. It is very important with this type generator that the lamp load should not exceed the maximum rating for the particular generator (see tables on car data sheets and article on shunt type lamp control generator).

PERFORMANCE:—Current Regulators used on 1934 car models should perform in accordance with the following table:

Regulator Type	Maximum Lamp Load	Maximum Cold Generator Ouput Lights Off	Lights On
x-5541	11 amperes	14-16 amperes	19-21 amperes
5543	7 amperes	7.5-8.5 amperes	11-13 amperes
5545	7 amperes	6.5-7.5 amperes	10-12 amperes

(x) This type Current Regulator is compensated for temperature and should be adjusted at room temperature (70°F.).

Cutout Relay on all types Current Regulators is similar to units used singly on Delco-Remy generators. See separate article on adjustment of all Cutout Relays.

ADJUSTMENT:—Check mechanical specifications of Current Regulators before testing or adjusting performance. Follow procedure below:

Mechanical Adjustment:—Air Gap. Press down on armature until fiber bumper touches the stop. Hold in this position and check air gap between center of core and armature with feeler gauge. Air gap should be .055-.060". Adjust by bending lower stop.

Contact Gap. Hold armature down against lower stop and check contact gap. Gap should be .015-.025". Spring tension should be 2¾ ounces measured at contacts.

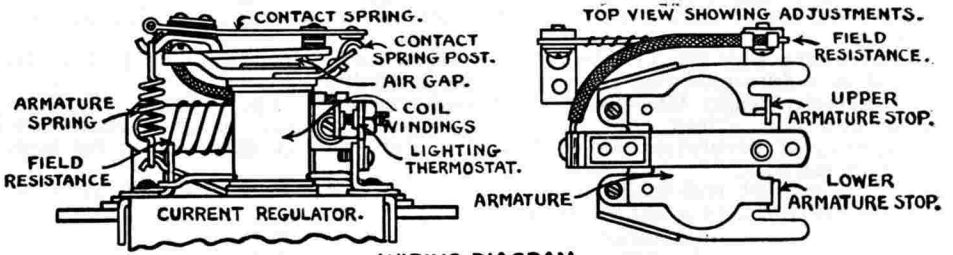
Contact Spring Gap. Release armature. With contacts closed, measure gap between fiber bumper and contact spring stop. Correct air gap is .006-.008". Adjust by bending upper stop.

Electrical Adjustment:—Connect accurate ammeter in charging circuit at battery terminal. Operate generator and note generator output. If output is not correct (see performance table above), adjust as follows:

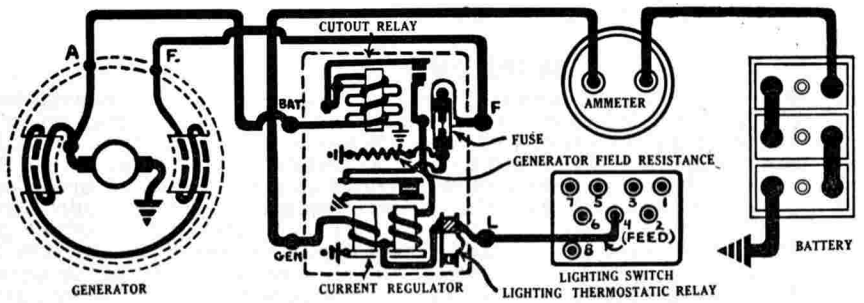
To Increase Output. Increase armature spring tension by bending lower spring bracket down.

To Decrease Output. Decrease armature spring tension by bending lower spring bracket up.

Check output with cover in place on regulator and repeat adjustment until correct setting is secured.



WIRING DIAGRAM.



LAMP LOAD:—Lamp load should be checked by connecting an ammeter in circuit at the regulator 'L' terminal. Lamp load must not exceed maximum rating for the particular type generator.

THERMOSTAT:—A thermostatic relay (thermostatic arm type circuit breaker) mounted within the control unit case is connected in the lamp circuit to protect the regulator and generator from overloads. Thermosat contacts open with load of 20 amperes with an air temperature of 210°F. (thermostatic arm temperature will be 375-385°F.).

DELCO-REMY CONTROL UNITS

VOLTAGE CONTROL RELAY TYPE

DESCRIPTION:—The Voltage Control Relay is a new type regulator used on a number of the new car models. It consists of a relay which cuts a fixed resistance unit in series with the generator field when the generator voltage reaches the maximum point for which the unit is set and cuts this resistance out when the voltage falls to the minimum for which the unit is set. This provides a higher charging rate for a discharged battery and reduces the charging rates rate when the battery becomes charged (voltage of third brush control type generator normally rises as battery comes up on charge). The resistance is a fixed unit and is merely cut in or out of the field circuit by the opening and closing of the relay contacts.

OPERATION:—The voltage control relay has only one winding (there are two coils but windings are connected in parallel). When the generator voltage reaches the maximum point for which the unit is set, the current flow through the coil winding opens the relay contacts, cutting the resistance into the field circuit. The contacts remain open (providing the lower charging rate) until the generator voltage falls to the minimum point and then close so that the higher charging rate is resumed. The resistance is connected across the relay contacts and is short-circuited with the contacts closed.

PERFORMANCE:—Voltage Control Relays used on 1934 car models should perform in accordance with the following table:

Control Unit Type	Voltage Control Relay	
	Contacts Open	Contacts Close
5540	8.3 volts	7.2 volts
5542	8.3 volts	7.2 volts
x-5544	8.3 volts	7.2 volts
x-5548	8.3 volts	7.2 volts
5550	8.3 volts	7.2 volts

Cutout Relay on Types marked (x) has auxiliary ground contacts mounted above the armature for starter solenoid relay or signal light control. Cutout Relays on all types are similar to units used singly on Delco-Remy generators. See separate article for adjustment of all Cutout Relays.

ADJUSTMENT:—Check mechanical specifications of Voltage Control Relay before testing or adjusting performance. Follow complete procedure below:

Mechanical Adjustment:—Air Gap. Hold armature down against lower stop and check gap. Use feeler gauge. Air gap should be .038". Spring tension measured at contacts should be ¾ ounce.

Armature Travel. Gauge armature travel (between lower stop and under side of armature with armature up against upper stop). Adjust by bending upper armature stop backward or forward.

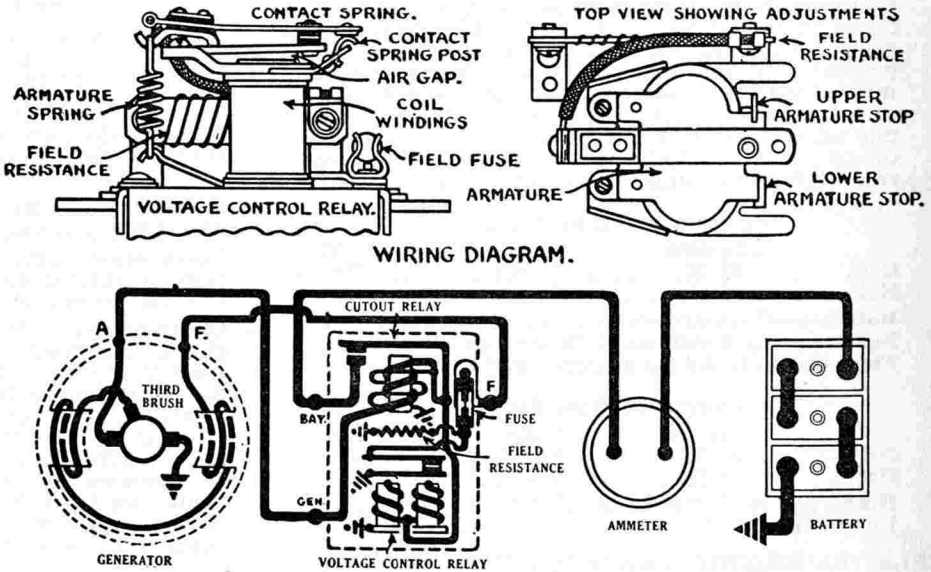
Contact Gap. Hold armature down against lower stop. Contact gap should be .008-.013".

Electrical Adjustment:—Connect accurate voltmeter between terminal marked 'Bat' and ground. Operate generator charging a fully charged battery until control unit is thoroughly warm. With cover in place and control unit warm, cycle generator by increasing speed until voltage control relay contacts just open and then decrease speed until contacts just close. Then repeat test and note voltmeter reading at instant contacts open and close. Voltage Control Relay performance should agree with table above. If operating voltages cannot be secured even with generator charging a fully charged battery, connect a variable resistance or fixed resistance of about .25 ohms in charging circuit. Resistance must have sufficient current carrying capacity to take entire generator load (20-25 amperes). If performance is not correct, adjust as follows:

Cut-in (contact opening) Voltage Adjustment. Increase armature spring tension to increase operating voltage, or decrease armature spring tension to decrease operating voltage. Adjust by bending spring lower bracket. Correct spring tension before making this adjustment is ¾ oz. measured at contacts.

Cut-out (contacts closing) Voltage Adjustment. Increase armature air gap to increase operating voltage or decrease air gap to decrease operating voltage. Adjust by bending lower armature stop. Adjustment to correct closing voltage should be very slight. If it is necessary to change air gap considerably, recheck armature travel and contact gap, then repeat test.

NOTE:—The Voltage Control Relay is over-compensated for temperature variations and the contact opening and closing points with relay hot will be lower than with relay cold. For this reason the generator should be operated for a sufficient time to thoroughly warm up the control unit before tests and adjustments are made.



CHARGING RATE ADJUSTMENT:—It should be remembered that the Voltage Control Relay establishes a high and low charging rate. The actual charging rate (maximum for both 'high' and 'low' rates) is determined by the third brush setting of the generator. The third brush is adjusted in the usual manner except that the Voltage Control Relay must be shorted out by connecing a jumper wire from the generator 'F' terminal to ground while the adjustment is being made in order to prevent regulator action. See individual car data sheets for standard settings and allowable maximum settings for each generator. Data given in 'Performance Data' tables is the maximum rating for the particular generator and must not be exceeded. Be sure to remove the jumper wire after the adjustment is completed.

SPECIAL GENERATORS

AS USED ON 1934 CAR MODELS WITH RADIO, HEATERS, ETC., INSTALLED

BUICK

MODELS 34-50, 34-60, 34-90 (1934)

Model 929-B (Radio or City Police Service).
Model 956-L (Radio or State Police Service).
Third brush control type with external voltage regulation (regulator in case with cutout relay on generator field frame). See separate article for complete data on Voltage Control Relay. Generators are ventilated (929-B by air scoop, 956-L by fan on armature shaft within generator). Model 929-B produces maximum output at speed lower than standard generator and should be used when car is driven extensively at low speed. Model 956-L produces maximum output at higher speed and should be used on cars driven at high speed.
Charging Rate Adjustment:—Use test meters to check generator output. Short out Voltage Control relay by connecting a short jumper wire from generator 'F' terminal to ground. Slotted adjustment lever is located on commutator end plate directly below distributor. Loosen clamp screw one turn, move lever down (clockwise) to increase or up (counter-clockwise) to decrease charging rate, tighten clamp screw. Remove jumper wire.

Performance Data 929-B

	Amperes	Volts	R.P.M.
Cold	23-26	8.8-9.1	2200
Hot	17-20	8.1-8.5	2400

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—20-28 ozs. (all brushes).
Field Current—1.8-2.3 amperes at 6.0 volts.

Performance Data 956-L

	Amperes	Volts	R.P.M.
Cold	23-26	8.6-8.9	2500
Hot	18-21	8.2-8.5	2800

Brush Spring Tension—20-26 ozs. (all brushes).
Field Current—2.1-2.5 amperes at 6.0 volts.

RELAY-REGULATOR (CONTROL UNIT):—Model 5544. Mounted on generator field frame. Consists of Cutout Relay and Voltage Control Relay (voltage regulator). See special article for complete data on Voltage Control Relay.

Cutout Relay

Cuts in—6.6-6.8 volts.
Cuts out—3 ampere discharge maximum.
Contact Gap—.015-.025".
Air Gap—.012-.017" (contacts closed).

Voltage Control Relay

Contacts Close—7.2 volts. **Contacts Open**—8.3 volts.
Contact Gap——.008-.013".
Air Gap—.038" between armature and core (armature down against lower stop.
.028" armature travel (between armature and lower stop).

CHEVROLET

MASTER MODEL DA (1934)

Model 967-E (cars with radio). Armature No. 1836971. Third brush regulation, thermostat control. Thermostat contact opening inserts resistance in field circuit, reducing output approximately 40%.
Charging Rate Adjustment:—Take off commutator cover band, loosen lock screw on commutator end plate, shift third brush by hand counter-clockwise to increase, or clockwise to decrease charging rate, tighten locing screw.
Maximum Charging Rate:—12 amperes (hot), 7.7 volts, 2400 R.P.M. or 23 M.P.H.

Performance Data

	Amperes	Volts	R.P.M.
Cold	19-22	8.3-8.7	2000
Hot	11-14	7.5-7.9	2200-2600

Rotation—Counter-clockwise at commutator end.
Shunt Field Current—2.1-2.5 amperes at 6.0 volts.
Brush Spring Tension—20-26 ounces each.

Model 931-N (City Police). Armature No. 1853375.
Model 931-S (State Police). Armature No. 1853093.
Third brush control with external voltage regulation (regulator combined with relay cut-out in case on generator field frame).
Charging Rate Adjustment:—Use test meters to check generator output. Connect jumper wire from '3' regulator terminal to ground (important, as voltage regulator must be shorted out while adjustment is being made). Loosen lock screw on commutator end plate, shift third brush by hand, counter-clockwise to increase, or clockwise to decrease charging rate until output is as shown on table below, tighten locking screw, remove jumper wire. See special article for complete data on Voltage Regulator.

931-N Performance Data

	Amperes	Volts	R.P.M.
Cold	22-24	8.6-9.0	1300
Hot	13.5-16.5	7.7-8.1	1600-1800

931-S Performance Data

Cold	23-26	8.8-9.1	2300
Hot	17-20	8.1-8.5	2500

Rotation—Counter-clockwise at commutator end.
Shunt Field Current—3.5-4.0 amperes (931-N), 1.5-1.8 amperes (931-S) at 6.0 volts.
Brush Spring Tension—931-N—20-28 ozs. (all), 931-S—22-26 ozs. (main brushes), 16-20 ozs. (third brush).
Field Fuse—6 ampere capacity (under regulator cover).

RELAY REGULATOR (CONTROL UNIT):—Type 5025554 (used on 931-N, 931-S). Consists of relay cut-out, voltage regulator and field fuse in case on generator.

Relay Cut-out

Cuts in—6.3-6.9 volts.
Cuts out—4 ampere discharge (maximum).
Relay Contact Gap—.012-.015".
Air Gap—.011-.012" (contacts colsed).

Voltage Regulator

Adjustment—Open-circuit voltage should be 7.5-8.3 volts at output speed in table above. See special article for complete data on Regulator.
Regulator Contact Gap—.015" (min.).
Air Gap—.018-.020".

FORD

MODEL V-8-112 (1934)

See special article on Air-cooled Generator, Type 40-10000-B with Two-Rate Relay Type 40-10505A (Two-Rate relay now used only with radio installed).

GRAHAM

SPECIAL SIX, MODEL 68 (1934)

Model 935-J (Special—cars with radio). Armature No. 1854856. Third brush control with external voltage regulation. Voltage Control Relay combined with Cutout Relay in case on generator field frame. See special article for complete data on Voltage Control Relay.
Charging Rate Adjustment:—Use test meters to check generator output. Connect jumper wire from 'F' generator terminal to ground—voltage regulator must be shorted out while adjustment being made). Take off commutator cover band, loosen lockscrew on commutator end plate, shift third brush by hand counter-clockwise to increase or clockwise to decrease charging rate, tighteen lockscrew, remove jumper wire.

Performance Data

	Amperes	Volts	R.P.M.
Cold	19-22	8.3-8.7	2800
Hot	15-19	7.9-8.4	3100

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—22-26 ozs. (main), 16-20 ozs. (third brush).
Field Current—2.3-2.6 amperes at 6.0 volts.
Field Fuse—6 amperes (in regulator case).

RELAY-REGULATOR (CONTROL UNIT):—Model 5544 (935-J Generator). Consists of Cutout Relay and Voltage Control Relay in case on generator field frame. Cutout Relay has extra set of grounding contacts above armature for generator charging

SPECIAL GENERATORS

AS USED ON 1934 CAR MODELS WITH RADIO, HEATERS, ETC., INSTALLED

indicator signal light control. See Signal Lights. See special article for complete data on Voltage Control Relay.

Cutout Relay

Cuts in—7.0 volts. **Cuts out**—0-2.5 amp. discharge.
Relay Contact Gap—.015-.025".
Air Gap—.012-.017" (contacts closed).

Voltage Control Relay

Contacts Close—7.2 volts. **Contacts Open**—8.3 volts.
Contact Gap—.008-.013".
Air Gap—.038" between armature and core (armature down against lower stop).
.028" armature travel (between armature and lower stop).

GRAHAM

SPECIAL EIGHT, MODEL 67 (1934)

Model 967-N (Special—cars with radio). Armature No. 1844827. Third brush control type with external voltage regulation. Voltage Control Relay combined with Cutout Relay in case on generator field frame. See special article for complete data on Voltage Control Relay.

Charging Rate Adjustment:—Use test meters to check generator output. Connect jumper wire from 'F" terminal on generator to ground—voltage regulator must be shorted out while adjustment is being made). Take off commutator cover band, loosen lockscrew on commutator end plate, shift third brush by hand counter-clockwise to increase, or clockwise to decrease charging rate, tighten lockscrew, remove jumper wire.

Performance Data

	Amperes	Volts	R.P.M.
Cold	19-22	8.3-8.7	2100
Hot	12-15	7.6-8.0	2800

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ozs. (all brushes).
Field Current—2.1-2.5 amperes at 6.0 volts.
Field Fuse—6 ampere (in regulator case).

RELAY-REGULATOR (CONTROL UNIT):—Model 5548 (967-N Generator). Consists of Cutout Relay and Voltage Control Relay in case on generator field frame. Cutout Relay has extra set of grounding contacts above armature for generator charging indicator signal light control. See Signal Lights. See special article for complete data on Voltage Control Relay.

Cutout Relay

Cuts in—7.0 volts. **Cuts out**—0-2.5 amp. discharge.
Relay Contact Gap—.015-.025".
Air Gap—.012-.017" (contacts closed).

Voltage Control Relay

Contacts Close—7.2 volts. **Contacts Open**—8.3 volts.
Contact Gap—.008-.013".
Air Gap—.038" between armature and core (armature down against lower stop).
.028" armature travel (between armature and lower stop).

PIERCE ARROW

EIGHT CYLINDER, MODEL 836-A (1934)

EIGHT CYLINDER, MODEL 840-A (1934)

TWELVE CYLINDER, MODELS 1240-A, 1248-A (1934)

Model 929-A (De Luxe). Armature No. 1856943. Third brush control type with external voltage regulation (regulator combined with cut-out relay in case on generator field frame). Use test meters to check generator output when adjusting third brush. See special article for data on Regulator (Voltage Control Relay).

Charging Rate Adjustment—Use test ammeter and voltmeter to check generator output. Connect jumper wire from 'F" generator terminal to ground (important as Voltage Regulator must be shorted out while adjustment is being made). Shift third brush by hand counter-clockwise to increase, or clockwise to decrease charging rate, until output corresponds with table below.

Performance Data

	Amperes	Volts	R.P.M.
Cold	23-26	8.8-9.1	2200
Hot	17-20	8.1-8.5	2400

Rotation—Counter-clockwise at commutator end.
Shunt Field Current—1.8-2.3 amperes at 6.0 volts.
Brush Spring Tension—20-28 ounces.
Field Fuse—6 ampere capacity (in regulator case).

RELAY REGULATOR (CONTROL UNIT):—Model 5540 (929-A Generator). Consists of Cut-out Relay and Voltage Regulator in case on generator field frame. See special article for complete data on Voltage Regulator.

Cut-out Relay

Cuts in—7.0 volts. **Cuts out**—0-2.5 amp. discharge.
Relay Contact Gap—.015-.025".
Air Gap—.012-.017" (contacts closed).

Voltage Control Relay

Contacts Close—7.2 volts. **Contacts Open**—8.3 volts.
Regulator Contact Gap—.008-.013".
Air Gap—.038" between armature and core (armature down against lower stop).
.028" armature travel (between armature and lower stop).

PONTIAC

MODEL 603 (1934)

Model 931-R. Armature No. 1853375. Special equipment for cars with radio and City Police service. Third brush current control with external voltage regulation (regulator combined with Cut-out Relay in case on generator field frame). Use test ammeter and voltmeter to check output when making adjustments.

Charging Rate Adjustment—Use test meters to check output. Connect jumper wire between 'F" generator terminal and ground (this is important—voltage regulator must be shorted out when adjustment is being made). To adjust, loosen small round lock screw on commutator end plate, shift third brush by hand, counter-clockwise to increase, or clockwise to decrease charging rate until output checks with table below, tighten locking screw, remove jumper wire. See special article for complete data on Voltage Regulator.

Rotation—Counter-clockwise at commutator end.
Shunt Field Current—3.5-4.0 amperes at 6.0 volts.
Brush Spring Tension—20-28 ounces.

Performance Data

	Amperes	Volts	R.P.M.
Cold	22-24	8.6-9.0	1300
Hot	13.5-16.5	7.7-8.1	1600-1800

Field Fuse—6 ampere capacity in regulator case.

RELAY REGULATOR (CONTROL UNIT):—Model 5540 (931-R generator only). Consists of Cut-out Relay, Voltage Regulator, field fuse in case on generator field frame. See special article for complete data on Voltage Regulator.

Cut-out Relay

Cuts in—6.6-6.8 volts.
Cuts out—3 amperes discharge current maximum).
Relay Contact Gap—.015-.025"
Air Gap—.012-.017" (contacts closed).

Voltage Control Relay

Contacts Close, 7.2 volts. **Contacts Open,** 8.3 volts.
Regulator Contact Gap—.008-.013".
Air Gap—.038" between armature and core (armature down against lower stop).
.028" armature travel (between armature and lower stop).

SPECIAL GENERATORS

AS USED ON 1934 CAR MODELS WITH RADIO, HEATERS, ETC., INSTALLED

STUDEBAKER
DICTATOR, MODEL A (1934) AUTO-LITE

Model GAR-4605 (cars with radio). Armature No. GAR-2089. Third brush control type with external voltage regulator or Two-Charge Relay. See special article for complete data.

Charging Rate Adjustment—Use test meters to check generator output. Short out voltage regulator by connecting a short jumper wire from generator 'F' terminal to ground. Take off commutator cover band, shift third brush by hand counter-clockwise to increase, or clockwise to decrease charging rate. Third brush is held in position by friction. Remove jumper wire after making adjustment.

Performance Data (Cold)

Amperes	Volts	R.P.M.
0	6.4	750
4	6.75	900
8	7.1	1040
12	7.4	1200
16	7.7	1380
20	8.1	1675
24.8	8.5	2400

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-36 ozs. (new brushes).
Field Current—3.75-4.15 amperes at 6.0 volts.
Field Fuse—7.5 amperes (in regulator case).
Motoring Current—4.75-5.25 amperes at 6.0 volts.

VOLTAGE REGULATOR:—Mounted on generator field frame. Regulator contacts open when generator voltage reaches point for which unit is set, cutting a resistance in the field circuit and reducing the output approximately 50%. Maximum charging rate 24.8 amperes (regulator contacts closed), 10.4 amperes (regulator contacts open). See special article for complete data on Regulator.
Contact Gap—.005″ (minimum).
Air Gap—.030″ (contacts closed).

CUTOUT RELAY:—Model CB-4021S. Mounted on generator field frame.
Cuts in—6.4 volts, 750 R.P.M., 6.3 M.P.H. Voltage limits, 6.75-7.5 volts.
Cuts out—.5-2.5 amperes discharge.
Contact Gap—.025-.035″.
Air Gap—.010-.030″ (contacts closed).

STUDEBAKER
DICTATOR, MODEL A (1934) DELCO-REMY

Model 935-R (Cars with radio or heaters). Armature No. 1854856. Third brush control type with exteral voltage regulation. Voltage control relay mounted with cutout relay in case on generator field frame. See special article for complete data on Voltage Control Relay.

Charging Rate Adjustment:—Use test meters to check generator output. Connect jumper wire from 'F' generator terminal to ground (important as voltage regulator must be shorted out while adjustment is being made). Take off commutator cover band, loosen lockscrew on commutator end plate, shift third brush by hand counter-clockwise to increase charging rate, clockwise to decrease charging rate, tighten lockscrew. Remove jumper wire.

Performance Data

	Amperes	Volts	R.P.M.
Cold	19-22	8.3-8.7	2800
Hot	15-19	7.9-8.4	3100

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—22-26 ozs. (main), 16-20 ozs. (third brush).
Field Current—2.3-2.6 amperes at 6.0 volts.
Field Fuse—6 ampere (in regulator case).

RELAY REGULATOR (CONTROL UNIT): — Model 5542 (935-R). Consists of Cutout Relay and Voltage Control Relay in case on generator field frame. See special article for complete data on Voltage Control Relay.

Cutout Relay
Cuts in—6.6-6.8 volts.
Cuts out—3 amperes maximum discharge current.
Relay Contact Gap—.015-.025″.
Air Gap—.012-.017″ (contacts closed).

Voltage Control Relay
Contacts Close—7.2 volts.
Contacts Open—8.3 volts.
Regulator Contact Gap—.008-.013″.
Air Gap—.038″ between armature and core armature down against lower stop).
.028″ armature travel (between armature and lower stop).

STUDEBAKER
COMMANDER, MODEL B (1934)
PRESIDENT, MODEL C (1934)

Model 935-H (cars with radio).
Third brush control type with external voltage regulation. See special article on Voltage Control Relay (in case with Cutout Relay) on generator field frame.

Charging Rate Adjustment—Use test meters to check generator output. Connect jumper wire from 'F' generator terminal to ground (this is important as Voltage Control Relay must be shorted out while adjustment is being made). Take off commutator cover band, loosen lock screw on commutator end plate, shift third brush by hand counter-clockwise to increase or clockwise to decrease charging rate, tighten lock screw. Remove jumper wire.

Performance Data

	Amperes	Volts	R.P.M.
Cold	19-22	8.3-8.7	2800
Hot	15-19	7.9-8.4	3100

Rotation—Counter-clockwise at commutator end.
Field Current—2.3-2.6 amperes at 6.0 volts.
Brush Spring Tension—22-26 ozs (main), 16-20 ozs. (third brush).
Field Fuse—6 ampere (in regulator case).

RELAY-REGULATOR (CONTROL UNIT):—Model 5542. Consists of Cutout Relay and Voltage Control Relay in case on generator field frame. See special article for complete data on Voltage Control Relay.

Cutout Relay
Cuts in—6.6-6.8 volts.
Cuts out—3 ampere discharge maximum.
Contact Gap—.015-.025″.
Air Gap—.012-.017″ (contacts closed).

Voltage Control Relay
Contacts Close—7.2 volts. **Contacts Open**—8.3 volts.
Contact Gap—.008-.013″.
Air Gap—.038″ between armature and core (armature down against lower stop).
.028″ armature travel (between armature and lower stop).

CUTOUT RELAYS

DESCRIPTION:——All Cutout Relays used as automatic switches to disconnect the generator when it is not charging the battery and thus prevent the battery discharging through the generator windings are similar in operation although individual types and makes are somewhat different in construction. See special sections below for details of design and adjustment instructions for each type.

OPERATION:—There are two coil windings, a fine winding called the shunt or voltage coil, which is connected directly from the generator terminal to ground (on 'insulated' type coil is not grounded but is connected across generator main brushes), and a heavy winding called the series or current coil, which is connected in the charging line from the generator so that the entire generator output (charging current to battery) passes through it. The series coil is in series with the cutout relay contacts so that no current flows in this coil with the contacts open. When the generator is operated at speeds below the cut-in point (with relay contacts open), there is a small current flow through the voltage or shunt winding. At the cut-in point, the magnetic field created by the shunt coil is sufficiently strong to attract the relay armature, closing the relay contacts. The generator output then flows through the series coil and the relay contacts to the battery. As long as the generator speed is high enough to produce a charging current (generator voltage greater than battery voltage), the series coil acts in conjunction with the shunt coil to keep the contacts closed.

When the generator voltage falls below that of the battery, the current flow in the series coil is reversed and the battery discharges through the generator. The magnetic field created by the series field due to this reverse current opposes that of the shunt coil, and the relay contacts open, opening the circuit between the battery and generator and preventing a further discharge of the battery.

ADJUSTMENT:—Mechanical specifications (contact gap, air gap, armature spring tension, etc.) should be checked and adjusted before the performance (cut-in and cut-out points) are checked or adjusted. See instructions for individual types below.

AUTO-LITE CB-4000 SERIES STANDARD RELAY

MECHANICAL ADJUSTMENT:—Air Gap. Close relay contacts (hold armature down), measure air gap between armature and top of coil core, using a feeler gauge. Air gap should be within limits of .010-.030". Adjust by loosening lower contact mounting screw and shifting contact bracket up or down (early types) or by expanding or contracting lower contact support so as to raise or lower contact (later types).

Contacts. Examine contact surfaces. Contacts must be flat and parallel, free from dust or oil, and not burned or pitted. If necessary, resurface contacts with a fine file or #00 sandpaper.

Contact Gap. With armature up against upper stop, check contact gap. Contact gap should be within limits of .025-.035". Adjust by bending upper stop backward or forward.

ELECTRICAL ADJUSTMENT:—Cut-in (contact closing) Point. Connect an accurate voltmeter between generator terminal of relay and ground. Operate generator and slowly increase speed until contacts close. Note voltmeter reading (there will be a slight 'kick-back' or voltage drop as contacts close). Performance should be as follows:

Cutout Relay	Cut-in Voltage		Maximum
	Minimum	Maximum	Load
All 6 volt types	6.75	7.5	5 amperes
All 12 volt types	13.5	16.0	3 amperes

If performance is not satisfactory, adjust as follows:

To raise Cut-in Voltage. Increase air gap (see above) or increase armature spring tension by bending spring arm down (early types), or by bending lower spring bracket down (later types).

To lower Cut-in Voltage. Decrease air gap or decrease armature spring tension by bending spring arm up (early types), or by bending lower spring bracket up (later types).

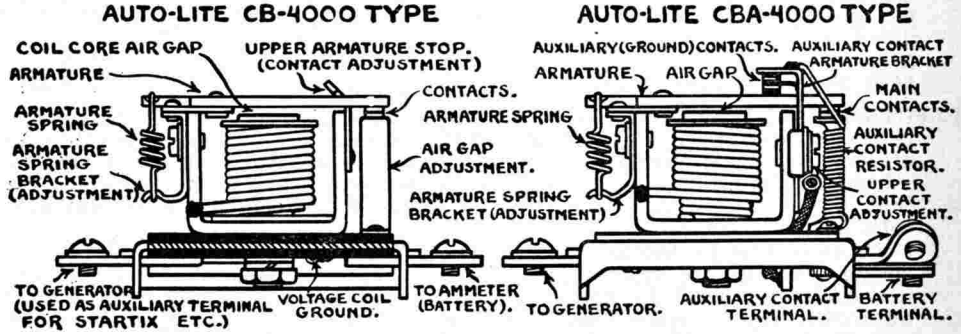
Cut-out (Contact opening) Point. Connect an ammeter in the charging line at the relay. Operate generator and slowly decrease speed until contacts open. Note ammeter reading (pointer will drop to '0' when contacts open). Performance should be as follows:

Cutout Relay	Discharge Current	
	Minimum Amperes	Maximum Amperes
All 6 volt types	.5	2.5
All 12 volt types	.5	2.5

If discharge current is excessive, increase armature spring tension and decrease air gap slightly.

AUTO-LITE CBA-4000 SERIES SPECIAL RELAY

This type relay has a special set of auxiliary ground contacts mounted above the armature for signal light control (auxiliary contacts are closed with main contacts open and open when main contacts close). See illustration). The auxiliary contacts were grounded directly on the first Type CBA-4001 relays. On later types (which may be identified by one terminal being copper-plated) these contacts were grounded through a 6 ohm resistor to prevent damage to the contact spring through overloading caused by accidental application of full battery voltage (signal light circuit current regulated normally by 6 volt, 3 cp. signal light in series with contacts).



MECHANICAL ADJUSTMENT:—Air Gap. Close relay contacts (hold armature down, measure air gap between armature and coil core, using a feeler gauge. Air gap should be within limits of .010-.030". Adjust by expanding or contracting lower contact support so as to raise or lower lower contact.

Contacts. Examine contact surfaces. Contacts must be flat and parallel, free from dust or oil, and not burned or pitted. Resurface contacts when necessary with a fine file or #00 sandpaper.

Contact Gap. With upper contacts closed, check lower or main contact gap. Contact gap should be within limits of .025-.035". Adjust by loosening upper contact support bracket screw (auxiliary contacts) and raising or lowering this upper contact. Check auxiliary contacts after adjusting contact gap. If these contacts do not open when main contacts close, adjust by bending auxiliary contact armature bracket (see illustration).

ELECTRICAL ADJUSTMENT:—All adjustments are the same as for the standard relay (see above). Performance should be as follows:

Cut-in (Contact Closing)

Minimum Voltage	Maximum Voltage	Maximum Load
7.0	8.0	5 amperes

Cut-out (Contact Opening)

Minimum	Discharge Current	Maximum
.5 ampere		2.5 amperes

NOTE:—A charging current of not less than 10 amperes must pass through the relay coil windings before this cut-out test is made.

CUTOUT RELAYS

DELCO-REMY TWO TERMINAL CUTOUT RELAYS (NO GROUND CONTACTS) AND CUTOUT RELAY IN TYPES 5540, 5542, 5550 CONTROL UNITS

MECHANICAL ADJUSTMENT:—Air Gap. Close contacts by hand (hold armature down), check air gap between armature and coil core using a feeler gauge. See table below for air gap limits. Adjust by loosening armature hinge bracket support screws and shifting armature up or down (later types with 'L' shaped armature hinged at side of coil frame), or by bending armature mounting, moving armature away from or toward core (first types with armature mounted on top of coil core). On this first type relay, check also the air gap between the brass contact support and the armature at a point directly behind the contacts. This gap must be within limits of .010-.020". Adjust by bending the brass contact support.

Contact Gap. With armature up against upper stop, check contact gap. See table below for contact gap limits. Adjust by bending upper stop backward or forward (all types).

Type	Contact Gap Limits	Air Gap Limits
263-A, C, D, F, G	.015-.025"	.012-.017"
263-B, E	.015-.025"	.014-.021"
264-A, B, C, D, H, L	.015-.025"	.012-.017"
265-A	.015-.025"	.014-.021"
265-B, C, D, E, G, H, J, K, L, M, N, P, R, T, U, V	.015-.025"	.012-.017"
266-A, B, C, D, L	.015-.025"	.014-.021"
266-E, F, G, H, J, K, P	.015-.025"	.012-.017"
267-A, B, C, D, E	.015-.025"	.014-.021"
270-A	.015-.025"	.014-.021"
5540, 5542, 5550 Control Units	.015-.025"	.012-.017"

ELECTRICAL ADJUSTMENT:—Cut-in (contact closing) Point. Connect an accurate voltmeter between generator terminal of relay and ground. Operate generator, slowly increase speed until contacts close. Note voltmeter reading (there will be a slight 'kick-back' or voltage drop when contacts close). See table below for voltage limits at cut-in point. If performance is not satisfactory, adjust as follows:

To raise Cut-in Voltage. Increase armature spring tension by bending spring post upward (later types with 'L' shaped armature), or by pulling armature stop back in notch and lifting up armature until contacts are approximately ¼" apart, then resetting armature stop and checking contact gap (first types with armature mounted on top of coil core).

To lower Cut-in Voltage. Decrease armature spring tension by bending spring post down slightly (later types), or by pressing armature down toward core (first types with armature mounted on coil core).

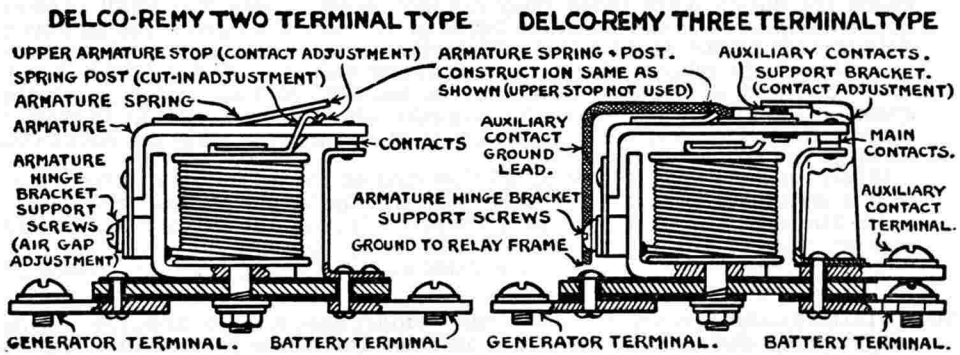
Cut-out (contact opening) Point:—Connect an ammeter in charging circuit at relay. Operate generator and slowly decrease speed until current reverses and contacts open. Note discharge current at instant contacts open (pointer will fall to '0'. See table below for discharge current limits. If discharge current is excessive, increase armature spring tension and decrease air gap slightly.

Cutout Relay Performance

Type	Cut-in Voltage Volts	Cut-out Current Amperes
263-A, C, D, F, G	6.75- 7.5	0-2.5
263-B, E	13.25-14.0	0-1.5
264-A, B, C, D, H, L	6.75- 7.5	0-2.5
265-A	6.0 - 6.5	0-1.0
265-B, C, D, E, G, H, J, K, L, M, N, P, R, T, U, V	6.75- 7.5	0-2.5
266-A, B, C, D, L	6.0 - 6.5	0-1.0
266-E, F, G, H, J, K, P	6.75- 7.5	0-2.5
267-A, B, C, D, E	13.25-14.0	0-1.5
270-A	6.75- 7.5	0-5.0
5540, 5542, 5550 Control Units	7.0	0-3.0

DELCO-REMY THREE TERMINAL CUTOUT RELAY (WITH GROUND CONTACTS) AND CUTOUT RELAY IN TYPES 5544, 5548 CONTROL UNITS

These types relays have a set of auxiliary contacts mounted above the armature for signal light or starter solenoid relay control. The auxiliary contacts are closed with the main contacts open and open when the main contacts close (see illustration). The upper contact of the auxiliary contacts serves as the relay armature upper stop.



MECHANICAL ADJUSTMENT:—Air Gap. Close contacts by hand (hold armature down) and check air gap between armature and coil core, using a feeler gauge. See table below for air gap limits. Adjust by loosening armature hinge bracket support screws and shifting armature up or down.

Contact Gap. With upper contacts closed (armature in extreme upward position) check contact gap. See table below for contact gap limits. Adjust by bending upper auxiliary contact support. After making adjustment see that upper contacts are closed with main contacts open and that upper contacts open when main contacts close.

Cutout Relay Specifications

Type	Contact Gap Limits	Air Gap Limits
264-K	.015-.025"	.012-.017"
265-S	.015-.025"	.012-.017"
5544, 5548 Control Units	.015-.025"	.012-.017"

ELECTRICAL ADJUSTMENT:—All adjustments are the same as for the standard relay later type with 'L' shaped armature (see above). Performance should be as follows:

Cutout Relay Performance

Type	Cut-in Voltage	Cut-out Current
264-K	6.75-7.5 volts	0-2.5 amperes
265-S	6.75-7.5	0-2.5
5544, 5548 Control Units	7.0	0-3.0

FORD VOLTAGE REGULATOR

TYPES 40-10505, 40-10505-A TWO RATE RELAY USED WITH AIR-COOLED TYPE 40-10000-B GENERATOR

DESCRIPTION:—The Voltage Regulator or Two Rate Relay is combined with the Cutout Relay in a case on the generator field frame. The regulator consists of a fixed resistance unit which is cut in or out of the generator field circuit by the action of the regulator contacts (resistance is connected across the contacts and is short-circuited with the contacts closed). Resistance is wound on a form over the regulator coil winding. This coil winding (shunt coil) is connected in parallel with the shunt winding of the cutout relay. Regulator is compensated for temperature variations by having one contact mounted on a thermal support.

OPERATION:—The regulator contacts are normally closed (resistance short-circuited) when the generator is not operating. The generator will charge the battery at the high rate until the generator voltage reaches 8.5 volts. At this point the current flow through the regulator coil winding will cause the regulator contacts to open, cutting the resistance in the field circuit, and reducing the charging rate to approximately 20% of the high rate. The contacts remain open, and the generator charges at the low rate until the generator speed decreases sufficiently so that the cutout relay contacts open. The regulator contacts then close so that generator will again charge at the high rate when the generator speed is increased sufficiently to close the cut-out relay contacts. This action provides two charging rates, a high rate with discharged battery or for a short interval after the generator begins to charge (regulator contacts closed), and a lower rate after the battery is charged (regulator contacts open).

The regulator also acts as a safeguard against high voltage due to resistance in charging circuit, high internal resistance in battery, or other causes, since these factors all cause the generator voltage to rise and the regulator will operate when the generator voltage reaches 8.5 volts even when the battery is not fully charged (generator voltage normally rises as battery voltage comes up on charge).

CHARGING RATE ADJUSTMENT:—The maximum normal rated capacity of the generator used with the regulator (Type 40-10000-B Air-cooled) is 18 amperes instead of 12 amperes when regulator is not used. No damage will result with this higher setting as the generators are air-cooled by having air drawn through the generator by impellor blades on the generator pulley, and the regulator will prevent over-charging and consequent heating of the generator. The 18 ampere setting is the allowable maximum and the charging rate should not be set higher than is necessary to take care of the particular current requirements of the car and to keep the battery charged.

To Adjust Charging Rate. See that regulator contacts are closed while adjustment is being made. This can be done by grounding field lead (black wire) to generator frame. Shift third brush in counter-clockwise direction as viewed from commutator end to increase charging rate, or in opposite direction to decrease charging rate. Third brush is held in position by friction.

GENERATOR PERFORMANCE:—The normal rating of the Type 40-10000-B generator is 18 amperes (cold) when used with Voltage Regulator, or 12 amperes without regulator, reached at 1500 R.P.M. or 20 M.P.H.

Generator Performance (Hot)

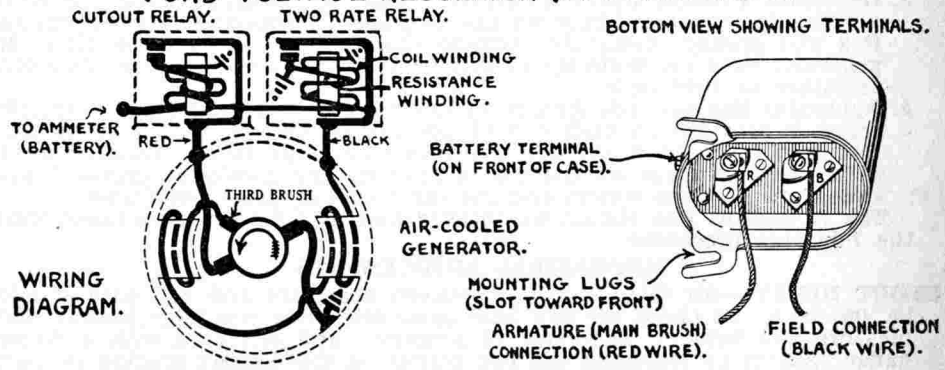
Amperes	Volts	R.P.M.	M.P.H.
0	6.1	660	8.8
4	6.25	795	10.6
8	6.5	960	12.8
12	6.7	1150	15.2
16	6.95	1500	20.0
18	7.1	1875	25.0

Rotation—Counter-clockwise at commutator end.

Field Current—5 amperes (maximum).

Brush Spring Tension—16 ounces.

FORD VOLTAGE REGULATOR (TWO RATE RELAY).



NOTE:—The first 1934 Ford V-8 cars were equipped with a Type 40-10000-A generator and a Type 10505 cutout relay. This generator is the same as the Type 40-10000-B generator except that maximum rated capacity is 12 amperes instead of 18 amperes for the 40-10000-B. The Type 40-10000-B air-cooled generator has been used for all cars since the 40-10000-A generator was discontinued. The Type 40-10505 or 40-10505-A Voltage Regulator was used in regular production on some cars but is now used only when radio is original equipment and should be installed when radio is put on the car. A Type B-10505 relay is now used instead of the Voltage Regulator. See car page for details of this cutout relay and wiring connections (terminal location has been reversed from previous practise—care must be taken to avoid incorrect installation and connection of the relay).

DELCO-REMY REGULATORS

6 AND 12 VOLT TYPES

Delco-Remy Regulators or 'Apparatus Boxes' are made in two types: a two-element (Cutout Relay and Voltage Regulator) type used in conjunction with third brush control generators, and a three-element (Cutout Relay, Current Regulator, and Voltage Regulator) type used with shunt wound generators. Both types of units are checked and adjusted in exactly the same manner and no distinction is made between them in the following discussion except that the material on the Current Regulator applies only to the three-element Apparatus Box. The maximum output of the third brush controlled generator used with the two-element Apparatus Box is regulated by the third brush setting (see paragraph on Third Brush Setting). First check following points:

1. **Connections.** See that all connections are clean and tight and that generator and Apparatus Box are correctly wired up (see diagram).
2. **Commutator and Brushes.** Clean commutator and examine brushes. If commutator is rough or worn down to the mica it should be turned down in a lathe (taking a very fine cut) and the mica then undercut to a depth of 1/32 inch. Brushes must seat over at least 75% of the bearing surface and should be sanded in if necessary.
3. **Generator Voltage.** Check generator voltage by operating generator with a voltmeter connected between the 'Armature' terminal on the Apparatus Box and ground. Generator voltage should build up to 13-14 volts. If generator does not build up to this point check for shorted or grounded armature or field coils.
4. **Apparatus Box Ground.** Apparatus Box must be well grounded. A ground screw is provided on each end of the Apparatus Box and, if Apparatus Box is not grounded through the frame by being firmly mounted on a clean metal surface on the car, a ground wire should be provided between one of these screws and the car frame or generator frame.

The Apparatus Box should be checked and adjusted in accordance with the following procedure:

MECHANICAL ADJUSTMENTS

CUTOUT RELAY:—Air Gap. Air gap between armature and coil core should be .050 inch. To check air gap hold armature down (contacts closed) and measure gap between underside of armature and coil core with a feeler gauge. Adjust by loosening the two screws on the contact bracket support and shifting the position of the stationary contacts (the contact bracket support mounting screw holes are slotted to permit this adjustment). Tighten the screws after making this adjustment.

Contact Gap. Contact gap must be .020-.025 inch. Check with a feeler gauge. Adjust by bending the armature stop above the armature (between the upper contact fingers).

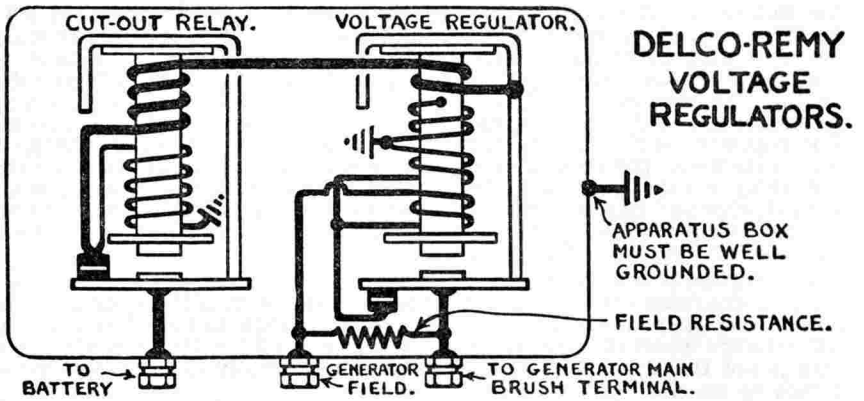
CURRENT REGULATOR AND VOLTAGE REGULATOR:—Contact Gap. Contact gap should be .012-.015 inch. To check contact gap, hold armature down against coil core and measure gap with a feeler gauge. Adjust gap by loosening lock nut on stationary contact stud (upper contact) and turning down stud. Tighten lock nut after making adjustment so that gap will not change in service. On first type Current Regulators and Voltage Regulators the stationary contact was soldered in place and no provision for adjustment was made. On units of this type, it will be necessary to replace the upper fibre contact bracket assembly.

To Replace Contacts. Take off old upper fibre contact bracket (with upper contact soldered in place) by taking out four screws on top of unit. Replace with new type upper fibre contact bracket assembly with upper contact mounted on an adjustable stud. Adjust contact gap as directed above. Whenever the lower contact requires replacement, remove the old contact bracket assembly by taking taking out two screws. In mounting the new contact bracket assembly see that it is moved down as far as possible on the mounting screws before the screws are tightened. The spring on which the upper (stationary) contact is mounted should be slightly above the fibre insulator when the contact points are closed so that the contacts will open with a wiping motion. In measuring the gap care must be taken not to change the normal position of the upper contact by placing any tension on the spring.

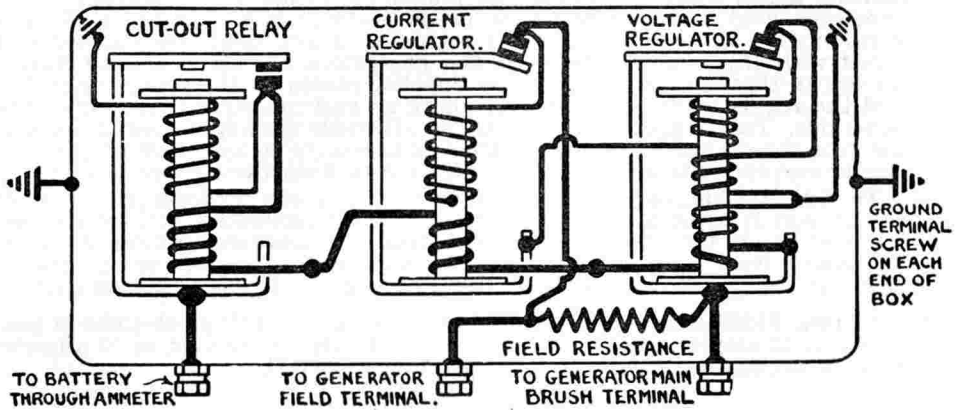
ELECTRICAL ADJUSTMENTS

CUTOUT RELAY:—Cut-in Point. Connect negative (—) terminal of test voltmeter to 'Armature' terminal on Apparatus Box and ground positive (+) terminal of voltmeter to Apparatus Box case. Short out Voltage Regulator by connecting one end of a short jumper to the upper contact support on the regulator and connect the other end of the jumper to the armature on which the lower contact is mounted. Operate generator and slowly increase generator speed until relay contacts close. Note voltmeter reading at instant contacts close (there will be a slight 'kick-back' of the voltmeter pointer when the contacts close and this can be used to check the closing point). Contacts should close with a generator voltage of 13-14 volts (12 volt units), 6.5-7 volts (6 volt units). To adjust closing point, change relay armature spring tension by loosening lock screw on lower spring bracket and turning eccentric adjusting screw. Increase the spring tension to raise the cut-in voltage and decrease the spring tension to lower the cut-in voltage. Tighten the lock screw and repeat the test until a satisfactory setting is secured.

TWO ELEMENT APPARATUS BOX.



THREE ELEMENT APPARATUS BOX.



Cut-out Point. Connect a test ammeter in the battery line (disconnect the lead on the 'Ammeter' terminal of the Apparatus Box and connect this lead to one terminal of the test ammeter and connect the other ammeter terminal to the 'Ammeter' terminal on the Apparatus Box). Operate the generator at a speed above the cut-in point so that generator is charging the battery and slowly decrease the speed until the relay contacts open. Note the ammeter reading at the instant the contacts open (the ammeter pointer will drop to '0' and then indicate a reverse current as the generator speed decreases). Contacts should open with discharge of 0-3 amperes.

CURRENT REGULATOR (Three-element Apparatus Boxes only):—Disconnect lead on 'Ammeter' terminal of Apparatus Box and connect to positive (+) terminal of test ammeter. Connect negative (—) terminal of test ammeter to 'Ammeter' terminal on Apparatus Box. The Voltage Regulator must be shorted out (see Cut-out Relay adjustment). Operate the generator and

DELCO-REMY REGULATORS

6 AND 12 VOLT TYPES

increase the speed to the maximum for the particular generator (see table below, Special Note, and Individual Car Data Sheets). Turn on enough lamp load to cause Current Regulator to begin operation. Note ammeter reading. If generator output as indicated by ammeter reading does not correspond with rated setting for the Apparatus Box, the Current Reulator setting must be changed. To adjust Current Regulator, loosen lock screw on lower spring bracket and turn eccentric adjusting screw. Eccentric adjusting screw should be turned to the right or clockwise to decrease the generator output and to the left or counter-clockwise to increase the output. Tighten the lock screw and check the adjustment by repeating test.

Special Note:—The Types 5526, 5529 and 5530 Apparatus Boxes are designed for particular generator outputs and the Current Regulators on these units should be accurately adjusted to the maximum output as listed below. The Current Regulator used in the Type 5530 Apparatus Box has either a two-turn or three-turn armature. The setting with the standard two-turn armature is 50 amperes (40 amperes with three-turn armature).

Apparatus Box	Maximum output (Current Regulator Setting)
5526	40 amperes
5529	18 amperes
5530	50 amperes—two-turn armature
5530	40 amperes—three-turn armature

THIRD BRUSH SETTING (Two-element Apparatus Boxes only):—To check third brush setting on generators used with a two-element Apparatus Box, first connect test ammeter in charging line and short out Voltage Regulator as directed in paragraph above on Current Regulator. Then operate generator at speed indicated in table below and change third brush setting until generator output corresponds with maximum rated capacity for the particular machine being tested (see table and individual car data sheets). Shift the third brush in the direction of armature rotation to increase the charging rate and in the opposite direction to decrease the charging rate.

VOLTAGE REGULATOR:—Voltage Regulator should be checked and adjusted on open circuit. Disconnect the battery lead at the 'Ammeter' terminal on the Apparatus Box. Connect the negative (—) terminal of the test voltmeter to the 'Ammeter' terminal on the Apparatus Box and ground the positive (+) lead of the voltmeter to the Apparatus Box case. Operate the generator at the speed shown on the table below and note the voltmeter reading. If the voltage is not within 14.75-.15.0 volts (12-volt units), 8.5 volts (6-volt units), the Voltage Regulator setting should be changed. Loosen the lock screw on the armature spring lower mounting bracket plate and turn the eccentric adjusting screw to change the spring tension. Increase the spring tension to increase the open circuit voltage and decrease the spring tension to decrease the voltage. Tighten the lock screw after the correct setting has been secured and check the adjustment by varying the generator speed throughout the operating range.

If the specified open circuit voltage setting of 14.75-.15.0 volts results in overcharging of the battery due to the particular operating conditions of the equipment, the setting can be lowered slightly, resulting in a lower finish charging rate. The open circuit voltage must never be set below 14.0 volts (12-volt systems) as this would prevent the closing of the cutout relay contacts and the generator would not charge the battery.

GENERATOR OPEN CIRCUIT VOLTAGE TABLE

Voltage Regulator Setting

Generator	Apparatus Box	Voltage Setting	R.P.M.
361	5525	14.75-15.0	1400
392	5524	14.75-15.0	1800
401, 5, 7, 8, 9	5526	15.0	1400
402	5526	15.0	2000
410	5526	15.0	1400
416	5524	15.0	1800
418	5524	14.75-15.0	1600
419	5524	14.75-15.0	1600
433	5529	15.0	1400
461	5530	15.0	1400
465	5526	15.0	1400
466	5530	15.0	1700
467	5526	15.0	1400
522, 23, 25	5526	15.0	1400
532	5526	15.0	1400
551	5524	14.75-15.0	1600
554	5529	15.0	1400
554	5535	15.0	1600
931-N	5025554	7.5-8.3	1300
931-S	5025554	7.5-8.3	2300
970-E	5534	8.5	2000
970-F	5534	8.5	2000
970-G	5536	14.75-15.0	1800
973-E, F, N	5538	8.5	2000
975-F	5534	8.5	2000
975-R	5535	15.0	1600
975-U	5538	8.5	2000
SM-1120	5524	14.75-15.0	1600
SM-1324	5535	15.0	1800
SM-1333	5524	15.0	1600
SM-1364	5535	15.0	1600
SM-1439	5538	8.5	2000
SM-1449	5535	15.0	1600
SM-1544	5538	8.5	2000

GENERATOR OUTPUT TABLE

Current Regulator or Third Brush Setting

Generator	Apparatus Box	Maximum Output	Voltage	R.P.M.
361	5525	42	15.8	1100
x-392	5524	24-26	13	1100
401, 5, 7, 8, 9	5526	40	13	1100
402	5526	40	13	3000
410	5526	40	13	1100
x-416	5524	24-26	13	1300
x-418, 19	5524	24-26	13	1600
433	5529	18	13	3000
461	5530	50	13	1400
465	5526	40	13	1100
466	5530	50	13	1700
467	5526	40	13	1100
522, 23, 25	5526	40	13	1100
532	5526	40	13	700
x-551	5524	24-26	13	1600
x-554	5529	24-26	13	1600
x-554	5535	24-26	13	1600
x-931-N	5025554	28-30	8.6-9.0	1300
x-931-S	5025554	23-26	8.8-9.1	2300
x-970-E	5534	26-28	7	1400
x-970-F	5534	17-19	7	1200
x-970-G	5536	20-22	15-15.2	2000
x-973-E, F	5538	24-26	7	2000
x-975-F	5534	26-28	7	1400
x-975-N	5538	28-30	9.5-9.75	2200
x-975-R	5535	15-17	15.0-15.2	2200
x-975-U	5538	26-28	7	1400
x-SM-1120	5524	24-26	13	1600
SM-1324	5535	40	13	1100
x-SM-1333	5524	24-26	13	1600
x-SM-1364	5535	24-26	13	1600
x-SM-1439	5538	17-19	7	1200
x-SM-1449	5535	20-22	15.0-15.2	2000
x-SM-1544	5538	18-20	8.3-8.5	1300

(x)—Indicates Third Brush Current Control.

LEECE-NEVILLE REGULATORS

6 AND 12 VOLT TYPES

Voltage Regulator and Cutout Relay adjustments on both the two-element Control Unit (designed for use with third brush control generators) and the three-element Control Unit (for use with shunt wound generators) are made in exactly the same manner. No distinction is made between these two types in the following discussion except that the material on the Load Limit Controller (Current Regulator) applies only to the three-element Control Unit. Generator output on third brush control types using the two-element control unit is controlled by the setting of the third brush. The elements of the Control Unit should be checked in the order shown and the mechanical adjustments of each element must be checked in the order shown and the mechanical adjustments of each element must be checked before any attempt is made to check or adjust the electrical settings.

The Control Unit should be mounted in a vertical position and all connections between the battery, Control Unit, and generator should be clean and tight. Special test hook-ups for test ammeter and voltmeter are given for each test.

VOLTAGE REGULATOR:—Mechanical Adjustment. All gaps should be measured with the armature held down so that the stop pin is against the coil yoke.

Contacts. Examine Regulator Contacts. If necessary clean contacts by drawing 'crocus' cloth between them while holding contacts closed. Blow out all dust and draw a piece of clean, smooth paper between contacts while holding them closed. See that contact surfaces are square and parallel so that a good contact is established between them.

Hinge Gap. IMPORTANT. Check hinge gap between magnet frame or yoke and hinge (under armature) at hinge end of Voltage Regulator by means of a feeler gauge. If hinge gap is not between .008-.015 inch, adjust by loosening bracket screw on end of coil yoke and shifting hinge bracket up or down. Tighten bracket screw after making adjustment.

Contact Point Gap. Contact gap should be .020-.025 inch. Check with feeler gauge. Adjust by bending armature stop (upper contact support).

Core Gap. Core gap between armature and coil core should be .021-.026 inch. Check with feeler gauge.

Electrical Adjustment:—Open Circuit Setting. Disconnect battery lead from 'B' terminal on Control Unit. Connect test voltmeter from this terminal to ground. Clean Load Limit Controller contacts and close contacts by wedging a small piece of some non-conductor, such as a matchstick, below the armature. This wedge should be left in place to prevent Load Limit Controller operating while Voltage Regulator and Cutout Relay are being tested or adjusted. Operate generator for 15 minutes at R.P.M. in table below in order to bring Regulator up to operating temperature. Note voltmeter reading at the end of this period. If open-circuit voltage corresponds with figure given in table, the adjustment is correct. If voltage is not correct, adjust Regulator by turning Regulator adjusting nut above hinge bracket until exact voltage reading is secured. Tap Regulator armature several times at a point back of the armature stop to check Regulator operation. If voltage is held within range given in the table the setting is satisfactory. See that the loop end of the armature spring is in the grooves of the spring bracket and that the adjusting nut locking clip is in place so that the adjustment cannot change in service.

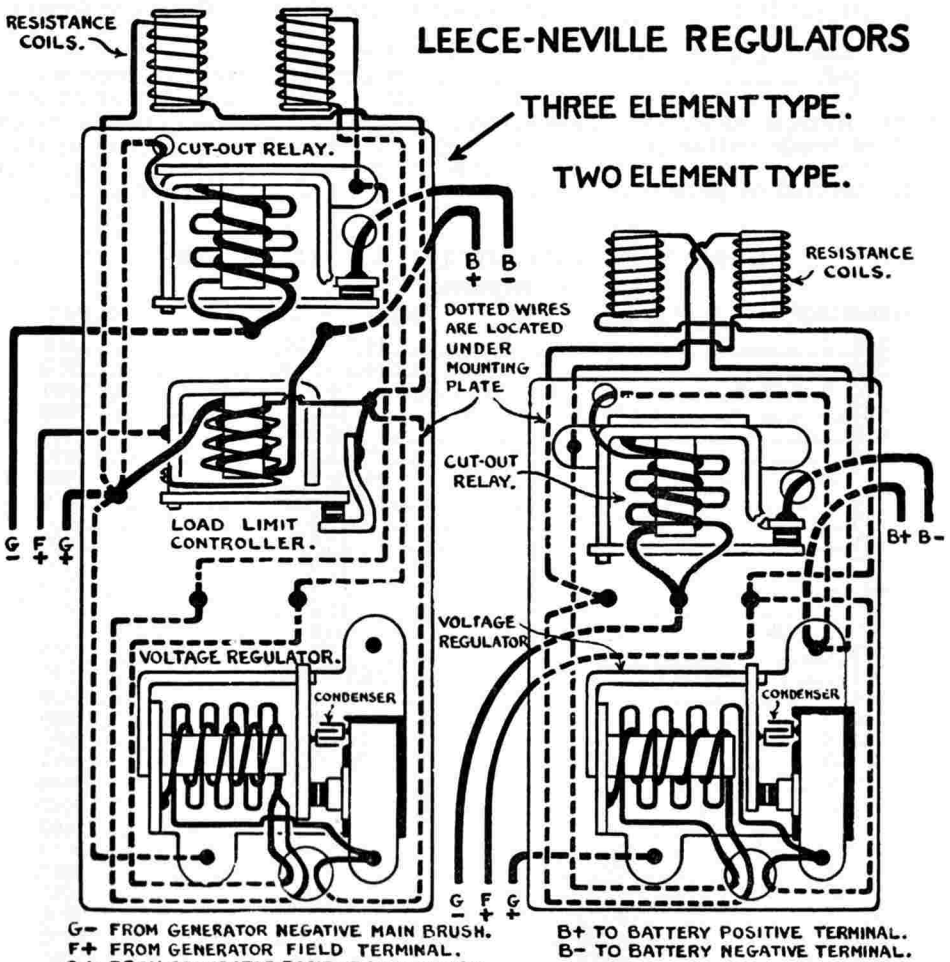
If the open circuit voltage varies widely for no apparent reason or if a correct setting cannot be secured, locate trouble from following table:

High Voltage. Check following points:—
1. Large resistance coil (upper coil in case) open circuited or disconnected.
2. Connections on terminals 'G+' and 'F+' reversed.
3. Lead to 'G—' terminal open circuited or disconnected.
4. Regulator point condenser shorted.
5. Regulator contact gap incorrect.
6. Regulator coil defective.

No voltage or very low voltage. Check following points:
1. Generator field fuse open. Check fuse and fuse clips.
2. Leads to 'G—' and 'F+' terminals shorted.
3. Leads to 'G+' or 'F+' terminals open circuited or disconnected.
4. Regulator coil defective.
5. Poor contact at Regulator contact points. Clean and adjust contacts.

Voltage varies widely for no apparent reason.
1. Small resistance coil (lower coil in case) open circuited or disconnected.
2. Regulator coil defective.
3. Poor contact at Regulator contact points. Clean and adjust contacts.
4. Regulator armature binding. See that armature moves freely and check hinge gap.

Arcing at Regulator Contacts.
1. Condenser disconnected or defective.
2. Poor contact at Regulator contact points. Clean and adjust contacts.
3. Regulator coil defective.
4. Small resistance coil (lower coil in case) open circuited or disconnected.
5. Open circuit voltage set too high.



CUTOUT RELAY:—Mechanical Adjustments. All gaps should be measured with the armature held down with the stop pin against the coil yoke. Do not guess at gap dimensions. Use a feeler gauge. This is important.
Contacts. Examine relay contacts. Clean contacts by drawing 'crocus' cloth

between them while contacts are held closed. Blow out all dust and finish by drawing a piece of smooth,clean paper between contacts while they are held closed. See that contact surfaces are square and parallel and that a good contact is established between them.

Hinge Gap. IMPORTANT. Check hinge gap between magnet frame or yoke and hinge under armature by means of a feeler gauge. If hinge gap is not within .008-.015 inch, adjust by loosening bracket screw on end of coil yoke and shifting hinge bracket up or down until correct gap is secured. Tighten bracket screw after making adjustment.

Contact Point Gap. Contact point gap should be .028-.032 inch. Check with a feeler gauge. Adjust by bending armature stop (directly above armature at contact end of relay).

Core Gap. Core gap between armature and coil core should be .020-.025 inch with relay contacts closed.

Electrical Adjustments:—To Set Cut-in Point. This test is made on open circuit with battery lead disconnected from 'B—' terminal on Control Unit. If desired a small (3 cp.) test lamp may be connected between this terminal and ground to determine the point at which the contacts close (the lamp will light up when the contacts close). Connect the test voltmeter between terminals 'G+' and 'G—' on the Control Unit. Operate the generator and slowly increase speed until relay contacts close. Note voltmeter reading at instant test lamp lights.

Relay cut-in point can also be checked by operating generator at a speed above the cut-in point and momentarily opening Voltage Regulator contacts by pressing on the regulator armature at a point directly behind the armature stop. The opening of the contacts in this manner will cause the generator voltage to drop to a very low figure and if the pressure on the regulator is released very slowly, the generator voltage will build up slowly enough so that the cut-in voltage (when the relay contacts close and the test lamp lights) can be noted on the voltmeter. This test requirees less time than the slowing down and increasing of the generator speed and should be used when successive tests are being made. If voltmeter reading corresponds with the figure in the table below, the relay setting is satisfactory. If the cut-in voltage is not correct, turn the adjusting nut at the top of the hinge bracket to the right or clockwise to increase the cut-in voltage and to the left or counter-clockwise to decrease the cut-in voltage. Repeat the test after each adjustment until the exact setting is secured. After the cut-in point has been set, the cut-out point or discharge current necessary to open the relay contacts must be checked. See that the loop ends of the armature spring are in the grooves of the spring bracket and that the adjusting nut locking clip is in place so that the adjustment cannot change in service.

To Check Cut-out Point. Connect battery lead to one terminal of test ammeter and connect other ammeter terminal to 'B—' terminal on Control Unit. This is a closed circuit check. Operate the generator at a speed above the cut-in point with the generator charging the battery and slowly decrease the generator speed until the relay contacts open. Note ammeter reading at the instant the contacts open. This discharge current must be within the range shown in the table above. If the discharge current is not correct, disconnect the battery and recheck the cut-in point as directed above.

If repeated adjustments fail to secure the correct setting, check trouble from following table:

If either Cut-in point or Cut-out point cannot be correctly set.

1. Cut-out relay windings defective.
2. Voltage Regulator winding defective.
3. Generator voltage low.
4. Poor contact at relay contacts. Clean and adjust cut-out relay contacts.
5. Generator to Control Unit wires disconnected or incorrectly connected.

If Cut-out Point is not correct.

1. Battery disconnected or connections defective (loose terminals).
2. Battery defective. Check battery and electrolyte level.
3. Battery connections reversed, causing relay contacts to vibrate.

LOAD LIMIT CONTROLLER:—The Load Limit Controller is designed to limit the generator output to the maximum rated capacity of the system. For this reason a low charging rate as indicated on the instrument panel ammeter means that the car battery is fully charged and should never be taken to mean that the Load Limit Controller should be adjusted. The Load Limit Controller should be checked on closed circuit with the generator charging the battery.

Mechanical Adjustment:—These are made in exactly the same manner as on the Voltage Regulator (the construction of the two units is similar). All settings are the same except that the core gap on the Load Limit Controller should be .020-.025 inch.

Electrical Adjustment:—Connect battery lead to one terminal of the test ammeter and connect the other ammeter terminal to the 'B—' terminal on the Control Unit. This is a closed circuit test with the generator charging the battery. Remove the wedge from the Load Limit Controller armature (see Voltage Regulator paragraph) so that Load Limit Controller can function. Operate the generator at R.P.M. shown in table below. Close Voltage Regulator contacts momentarily by pressing up on regulator armature. This will cause voltage to rise and charging rate to increase if Load Limit Controller is not correctly set. Note ammeter reading with Voltage Regulator contacts held closed. If ammeter reading is within range shown in table below, the Load Limit Controller setting is satisfactory. If reading is outside this range, turn the adjusting nut above the hinge bracket to the right or clockwise to increase the generator output and to the left or counter-clockwise to decrease the output until the correct setting is secured. The upper figure in the table is the maximum allowable output for the particular generator and must never be exceeded. See that the loop ends of the armature spring are in the grooves of the spring bracket and that the adjusting nut locking clip is in place so that the adjustment cannot change in service.

If it is not possible to secure a correct setting of the Load Limit Controller, check the following points:

1. Load Limit Controller winding defective.
2. Load Limit Controller incorrectly adjusted. See Mechanical adjustments and check condition of contacts, contact gap, and hinge gap.
3. Generator voltage too low. See Voltage Regulator paragraph.

THIRD BRUSH SETTING:—On all third brush control generators equipped with a two-element Control Unit, the generator maximum output is controlled by the third brush setting. To check third brush setting, connect battery lead to one terminal of the test ammeter and connect the other ammeter terminal to the 'B——' terminal on the Control Unit. Operate the generator at the R.P.M. shown on the Load Limit Controller adjustment table. Close Voltage Regulator contacts momentarily by pressing on Voltage Regulator armature. This will cause voltage to rise and generator charging current will increase if third brush is not correctly set. Note ammeter reading with Voltage Regulator contacts closed. If ammeter reading is within range shown in output column of Load Limit Controller Table, the third brush setting is correct. If reading is not correct, shift third brush in direction of armature rotation to increase output or against rotation to decrease output until exact setting is secured. The figure in the table is the maximum allowable output for the particular generator and must never be exceeded.

LEECE-NEVILLE REGULATORS

6 AND 12 VOLT TYPES

Equipment Type		Voltage Regulator Adjustment Table		Cutout Relay Adjustment Table		Load Limit Controller and Third Brush Adjustment Table	
Generator	Control Unit	Generator R.P.M.	Open-Circuit Voltage	Cut-in Voltage	Cut-out Discharge Current	Generator R.P.M.	Maximum Output
x-528-G	528-R	1500	14.4-14.6	11.7-12.3	2-4 amperes	1500	10 amperes
x-529-G	529-R	"	"	"	"	"	"
x-530-G	530-R	"	"	"	"	"	"
x-531-G	531-R	"	"	"	"	"	"
x-532-G	532-R	"	"	"	"	"	"
x-534-G	534-R	"	"	"	"	"	"
x-535-G	535-R	"	"	"	"	"	"
x-553-G	553-R	1350	"	"	"	1000	"
x-555-G	555-R	1350	7.4- 7.6	6.0-6.3	"	1350	15 amperes
x-590-G	590-R	2000	7.3- 7.5	"	"	2000	"
x-594-G	594-R	"	"	"	"	"	"
x-598-G	598-R	"	"	"	"	"	"
x-599-G	599-R	"	"	"	"	"	"
x-602-G	602-R	"	"	"	"	"	"
x-603-G	603-R	"	"	"	"	"	"
x-610-G	610-R	1500	14.4-14.6	11.7-12.3	"	1500	10 amperes
x-618-G	618-R	"	"	"	"	"	"
x-619-G	619-R	"	"	"	"	"	"
x-628-G	628-R	"	"	"	"	"	"
x-629-G	629-R	"	"	"	"	"	"
x-630-G	630-R	"	"	"	"	"	"
x-632-G	632-R	"	"	"	"	"	"
x-648-G	648-R	"	"	"	"	"	"
x-649-G	649-R	"	14.4-14.6	"	"	"	"
x-656-G	656-R	2000	7.3- 7.5	6.0-6.3	"	2000	15 amperes
x-659-G	659-R	1500	14.4-14.6	11.7-12.3	"	1500	10 amperes
x-668-G	668-R	"	"	"	"	"	"
x-669-G	669-R	"	"	"	"	"	"
x-672-G	672-R	2000	7.3- 7.5	6.0-6.3	"	2000	15 amperes
x-676-G	676-R	1350	7.4- 7.6	"	"	1350	"
x-678-G	678-R	2000	7.3- 7.5	"	"	2000	"
x-686-G	686-R	"	"	"	"	"	"
x-694-G	694-R	2000	"	"	"	"	"
x-698-G	698-R	1500	14.6-14.8	11.7-12.3	"	"	"
x-699-G	699-R	"	"	"	"	"	"
x-702-G	702-R	1350	14.4-14.6	"	"	1000	10 amperes
x-706-G	706-R	"	"	"	"	"	"
x-708-G	708-R	"	7.4- 7.6	6.0-6.3	"	1350	15 amperes
x-722-G	722-R	2000	7.3- 7.5	"	"	2000	"
x-724-G	724-R	"	"	"	"	"	"
x-734-G	734-R	"	"	"	"	"	"
x-736-G	736-R	1500	14.4-14.6	11.7-12.3	"	1500	10 amperes
x-740-G	740-R	"	"	"	"	"	"
x-762-G	762-R	"	"	"	"	"	"
x-764-G	764-R	2000	7.3- 7.5	6.0-6.3	"	2000	15 amperes
x-782-G	782-R	1500	14.4-14.6	11.7-12.3	"	1500	10 amperes
871-G	871-R	2500	7.4- 7.6	6.0-6.3	"	2000	25-27
x-882-G	882-R	1200	"	"	"	1200	10
910-G	910-R	2500	"	"	"	2000	25-27
911-G	911-R	"	"	"	"	"	"
912-G	912-R	"	"	"	"	"	"
914-G	914-R	"	"	"	"	"	"
915-G	915-R	"	"	"	"	"	"
947-G	947-R	1500	14.1-14.3	11.7-12.3	"	1500	15-17
984-G	984-R	"	"	"	"	"	"

x- Indicates third brush control generator using two-element Control Unit.

NORTH EAST REGULATORS

Voltage regulator and cutout relay adjustments on both the two-element Control Unit (for use with third brush control generators) and the three-element Control Units (for use with shunt wound generators) are made in exactly the same manner. No distinction is made in the following discussion between these two types except that the material on the Current Regulator Unit applies only to the three-element Control Unit. The special two-unit combined Current-Voltage Control Unit requires a special setting (see note under Voltage Regulator Unit).

Since the generator charging rate with voltage regulation depends upon the condition of the battery, the instrument panel ammeter does not indicate that generator performance is unsatisfactory or that adjusment is necessary. In general, the operation of the regulator unit should be checked whenever the generator is serviced or repaired. The generator should be checked whenever the regulator is set or the setting is changed. The exact procedure in checking and setting individual regulators will be found on the following pages. This procedure should be carefully and exactly followed. Preliminary procedure is as follows:

Generator. Check condition of generator commutator and brushes. Clean commutator and reseat brushes if necessary. Examine generator connections. See that all connections are clean and tight, see that generator is correctly hooked up. Check field fuse.

Regulator. Mount regulator in operating position (same position as on car). Use accurate voltmeter and ammeter to check settings—see illustrations and specific directions for hookup of instruments for each test. Make settings in following order:

1. Cut-out Relay. Mechanical Adjustments—Check condition of contacts and resurface if necessary, set contact gap; check and set core gap; check and set hinge gap. Electrical Adjustments—Check and set cut-in point; check and set cut-out point.

2. Voltage Regulator. Mechanical Adjustments—Check condition of contacts and resurface and align if necessary, set contact gap; check and set core gap (on North East units check length and clearance of core pin); check and set hinge gap; check sideplay of armature. Electrical Adjustments—Operate generator and set regulator to maintain correct open circuit voltage.

3. Current Regulator. Mechanical Adjustments—Check and set contact gap, check and set core gap (on North East units check length and clearance of core pin), check and set hinge gap, check sideplay of armature. Electrical Adjustment—Operate generator with full load and set regulator to maintain rated capacity of generator. On two-element control units with third brush current control, this setting is made by shifting the third brush to secure correct output.

MECHANICAL ADJUSTMENTS

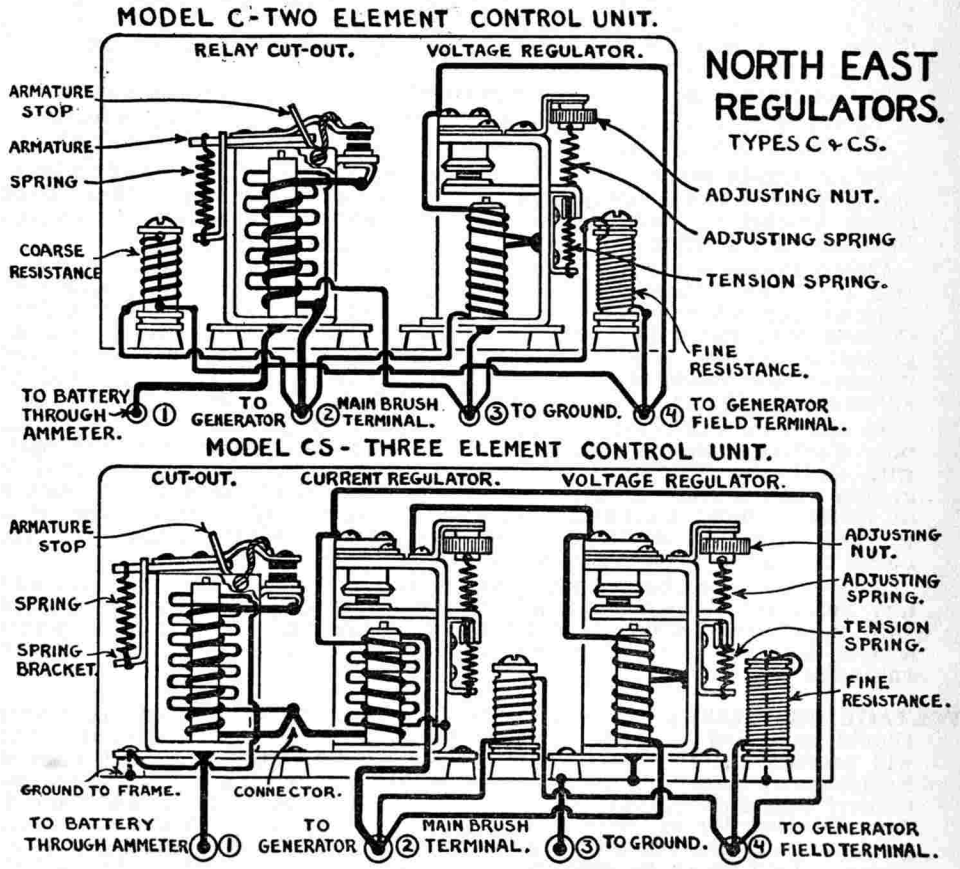
CUT-OUT RELAY:—Contacts. Check contacts by slipping off tension spring and removing armature (it will not be necessary to disconnect pigtails). If necessary resurface contacts with a fine flat contact file or No. 00 sandpaper. In re-installing armature see that pigtails do not bind under stop lug and that stationary contact is perfectly flat and armature contact slightly rounded. Align contacts by bending armature support lugs. On double contact type of relay see that contacts open and close simultaneously. Adjust by bending armature contact supporting fingers.

Armature Side Play. Side play of armature at contacts should be 1/64-1/32 inch to prevent binding. Adjust by bending armature support lugs. Tension spring must be unhooked before making this adjustment.

Core Gap Clearance. Double Contact Type—Air gap between coil core and armature should be .045 inch. Check with feeler gauge and set by bending stop lug above armature up or down. Single Contact Gap—Air gap should be .015 inch. Adjust by bending stop lug.

Contact Gap. Single and Double Contact Type—Contact gap should be .020-.025 inch. On single contact type adjust by bending lower (stationary) contact bracket. On Double Contact Type adjust by bending upper (armature) contact support fingers. The gap must be kept exactly the same on both sets to insure their opening and closing simultaneously.

VOLTAGE REGULATOR:—Contacts. On 6 and 12 volt systems with positive battery terminal grounded, stationary contact is of metal and armature contact of carbon. On systems with negative battery terminal grounded, both contacts are made of carbon. Contacts should be surfaced on a piece of No. 00 sandpaper laid on a flat surface and all dust brushed off with a fine brush. Contacts should never be touched with the fingers as greasy finger marks will interfere with correct operation. Align contacts after reassembly by shifting armature bracket after slacking off bracket screws (hinged armature type) or by bending support lugs on armature bracket (first type). Do not bend or twist armature bracket or hinge. On first type, see that sideplay of armature at contacts is 1/32-1/64 inch to prevent armature binding.



Core Gap Clearance. Check clearance between armature and magnet frame to see that armature has full movement without touching frame. Clean out all dirt. Check length of pin in coil core. If under .025 inch, pin should be replaced. If over .040 inch, pin should be filed down.

Contact Gap. Check contact gap by inserting feeler gauge between coil core pin and under side of armature with contacts closed. Gap should be .003-.005 inch. To set gap, loosen lock screw on stationary contact mounting bracket on top of magnet frame and turn stationary contact locking nut to raise or lower stationary contact. See that contact surfaces are square and parallel. To align contacts, loosen locking nut with locking screw tight, which will release ball-and-socket joint in contact thimble, press armature up firmly to close contacts and tighten locking nut.

CURRENT REGULATOR:—Same as for Voltage Regulator (above).

NORTH EAST REGULATORS

ELECTRICAL ADJUSTMENTS

CUT-OUT RELAY:—Cut-out Relay action may be checked on open or closed circuit. In each case the voltage regulator should be shorted out by connecting a short jumper between terminals 3 and 4 on the Control Unit. The generator should never be operated at excessive speeds with the voltage regulator out of the circuit as damage may result. For closed circuit operation all lights must be turned off.

Open Circuit Setting. Connect voltmeter between terminals 2 and 3 on Control Unit. Connect a test lamp (3 cp.) between terminals 1 and 3. Disconnect battery lead on terminal 1. Operate generator and gradually increase speed until test lamp lights, indicating that relay contacts have closed. Note voltmeter reading. Decrease generator speed until test lamp goes out, indicating that contacts have opened. Note voltmeter reading. These tests should be repeated several times. Correct settings for cut-in and cut-out points are as follows:

Type of Equipment	Contacts close	Contacts open
6 volt Relays	6.75 volts	5.75- 6.00 volts
12 volt Relays	13.00 volts	11.00-11.50 volts

To set Cut-in Point:—Change armature spring tension by bending lower spring bracket down (away from armature) to raise cut-in voltage. Bend spring bracket up (toward armature) to lower cut-in voltage. Check adjustment by repeating test until correct setting is secured.

Closed Circuit Setting. Disconnect generator lead on terminal 2 of Control Unit and connect this lead to one terminal of the test ammeter. Connect the other ammeter terminal to terminal 2 on he Control Unit. Connect voltmeter between terminals 2 and 3 on the Control Unit. Operate generator and gradually increase speed until kick-back of voltmeter pointer indicates that contacts have closed. Voltmeter readings and method of adjusting are the same as for open circuit testing as given above.

To check cut-out point of Relay, gradually decrease generator speed and note discharge current indicated on test ammeter. Contacts should open with discharge current of less than 5 amperes. If discharge current is greater than 5 amperes, increase air gap between coil core and armature as directed under mechanical adjustments above. If contacts open with the generator still charging, decrease the air gap. After changing air gap, check the cut-in point again and adjust if necessary.

Relay should be checked again after Voltage Regulator has been set and any necessary adjustments made to secure Relay performance in accord with data given above. As a final test, check cut-in and cut-out points several times by increasing and decreasing generator speeds and noting voltmetes readings.

VOLTAGE REGULATOR:—Before Voltage Regulator is adjusted, generator should be tested to make certain that it is operating satisfactorily and will produce the full rated output. To make this test, short out Voltage Regulator by connecting a short jumper between terminals 3 and 4 on the Control Unit and connect an accurate voltmeter between terminals 2 and 3. Operate generator at moderate speeds and note output (on straight shunt generators current will continue to rise with an increase of speed and generator should never be operated at speeds higher than the rated R.P.M. for maximum output). If generator produces rated output, remove jumper between terminals 3 and 4 and proceed with adjustment.

Open-circuit Setting. Take off battery lead on terminal 1 of Control Unit and operate generator on open circuit. Bring generator speed up to rated R.P.M. for maximum output. If regulator does not control voltage within two volts of correct figure (see table), turn adjusting nut to center of stud, adjust tension spring by bending spring toward armature to raise voltage or away from armature to lower voltage until setting is within 2 volts of correct figure. Operate generator for 15 or 20 minutes to allow regulator winding to reach operating temperature and check voltmeter reading at end of this period. If Voltage Regulator does not control voltage within 2 volts of correct figure, bend tension spring until approximate setting is secured. Then turn adjusting nut at upper end of adjusting spring to right (to increase operating voltage) or to the left (to lower operating voltage) until exact setting is secured. If it is necessary to turn the adjusting nut near the end of the stud to secure the correct setting, the nut should be turned back to the center of the stud and another preliminary adjustment made by bending the tension spring. After each adjustment the speed of the generator should be decreased and the generator then brought up to the rated R.P.M. figure again in order to overcome the effect of the residual magnetism of the regulator. Correct settings are given in the following table:

Equipment	Open Circuit Voltage
6 volt units	7.25 volts
12 volt units	14.5 volts

Check final setting by varying generator speed throughout operating range and checking voltmeter readings carefully.

Closed Circuit Check. After setting of Voltage Regulator has been completed on open circuit, the operation of the Voltage Regulator should be checked on closed circuit. Connect a variable resistance (carbon pile rheostat) between battery lead and terminal 1 on Control Unit. Connect test ammeter between terminal 2 and generator lead. Connect voltmeter beterminals 2 and 3 on Control Unit. Operate generator at correct speed to produce maximum output. Reduce resistance to minimum (screw up carbon pile) and note ammeter reading. Charging rate should be between finish rate and maximum charging rate of generator. Increase resistance (decrease pressure on carbon pile) until voltmeter reading indicates that Voltage Regulator is operating (voltmeter reading will correspond with setting of Voltage Regulator). Ammeter should indicate 'finish rate' or approximately 1-3 amperes. If generator output is higher than this figure the Voltage Regulator open circuit operation should be rechecked.

TWO-ELEMENT COMBINED CURRENT-VOLTAGE CONTROL UNITS:—On units of this type adjustments are made in exactly the same manner as directed for Voltage Regulators (above) but the open circuit voltage should be set at 17.00 volts to compensate for the action of the current coil. In checking the operation of the Control Unit on closed circuit, the variable resistance should be set to hold the voltage at 13 volts and the charging rate noted (ammeter reading should be 17-19 amperes). The resistance should then be adjusted to hold the voltage at 14 volts and the ammeter reading again noted. The generator output should show a drop of approximately 3 amperes or a charging rate of 14-16 amperes. If necessary the Voltage Regulator setting should be readjusted slightly to secure this result.

CURRENT REGULATOR:—The separate Current Regulator should be checked and adjusted on closed circuit. Connect the test ammeter between generator lead and terminal 2 on Control Unit. Short out Voltage Regulator by connecting a short jumper across Regulator contacts from upper contact support to regulator frame (do not connect terminals 3 and 4 on Control Unit as this would also short out the Current Regulator). Operate generator and increase speed gradually to rated R.P.M. for maximum output. Close Current Regulator contacts momentarily by hand and note whether generator output increases. Then release contacts and note at what point Regulator controls generator output. Regulator should be set in accordance with rated output figures for each individual generator.

The Current Regulator is adjusted in the same manner as the Votlage Regulator. Approximate settings are made by bending the tension spring and a final adjustment is secured by turning the adjusting nut at the upper end of the adjusting spring. The setting should be checked by operating the generator at various speeds throughout the entire range.

FINAL CHECK:—After all adjustments have been made on Control Unit, allow Unit to cool off and recheck Cut-out Relay cut-in point. If voltage Regulator operates before Cut-out Relay contacts close (which will prevent generator from charging until Control Unit warms up) the Voltage Regulator setting should be raised slightly but not more than .25 volts.

A final operating test should be made with the Control Unit cover in place and with the Control Unit mounted on the car.

AUTO-LITE STARTER CONTROLS

SOLENOID, TYPES SS-4001, SS-4002 (HUDSON, HUPMOBILE, TERRAPLANE EQUIPMENT)

DESCRIPTION:—These are conventional magnetic solenoid type switches mounted on the starter field frame and controlled by a pushbutton switch on the instrument panel. The feed wire for the switch solenoid is connected to the coil side of the ignition switch so that the starter is operative only with the ignition turned on. See car diagrams for wiring and connections of each installation.

OPERATION:—Two springs are used in connection with the solenoid coil to control the switch action. When the solenoid circuit is completed by pressing the pushbutton switch, the solenoid plunger is drawn into the coil against the tension of a light spring. After the main switch contacts close, the plunger compresses a second spring, insuring a positive connection at the switch contacts. When the pushbutton switch is released, breaking the solenoid circuit, this second spring quickly separates the main switch contacts, preventing arcing or burning of the contacts. The first spring then returns the solenoid plunger to the off position.

PERFORMANCE:—The solenoid coil winding resistance is 1.75-2 ohms and the coil draws approximately 3 amperes at 6 volts. Terminal voltage required for initial closing of switch contacts is less than 4 volts and plunger should bottom with not more than 5.25 volts. The switch releases when the terminal voltage falls to .75-2.0 volts. Switch has a capacity of 450 amperes at 10°F. or 250 amperes at 70°F. when held closed for not more than 4 minutes.

NOTE:—For emergency operation the switch can be operated by hand by taking off the brass cap on the end and pushing the plunger in by hand.

VACUUM CONTROL, TYPES VC-4001, VC-4002, VC-4003 (NASH EQUIPMENT)

DESCRIPTION:—This type starting switch is operated by the clutch pedal (clutch is disengaged to start engine), and uses a vacuum release and lock to prevent operation while the engine is running. The operating linkage must be adjusted whenever the clutch pedal is adjusted (see instruction below).

OPERATION:—The switch is mounted directly on the starter field frame and is linked to the clutch throw-out shaft by a cable and pulley mechanism. When the clutch pedal is depressed, the cam 'A' is rotated, operating the switch lever 'C' through the latch 'B'. The latch will be engaged whenever the engine is not running. When the switch lever 'C' is rotated, the roller on the lower end of the lever depresses the switch upper contact arm and closes the starting switch contacts. As soon as the engine begins to fire, the intake manifold vacuum acts on the vacuum unit on top of the switch case, the diaphragm moving up and disengaging the switch latch. As long as the engine is running, the switch latch is held in this upper or disengaged position so that subsequent rotation of the switch cam (whenever the clutch is disengaged) does not operate the switch. When the engine is stopped, the return spring in the vacuum unit engages the switch latch.

Two springs are used on the switch operating lever rod. A return spring attached to the end of the control rod returns the switch operating lever and cable linkage to the 'off' position when the clutch is engaged. The control rod spring is designed to permit full travel of the clutch pedal after the starting switch contacts are closed. This spring is adjustable.

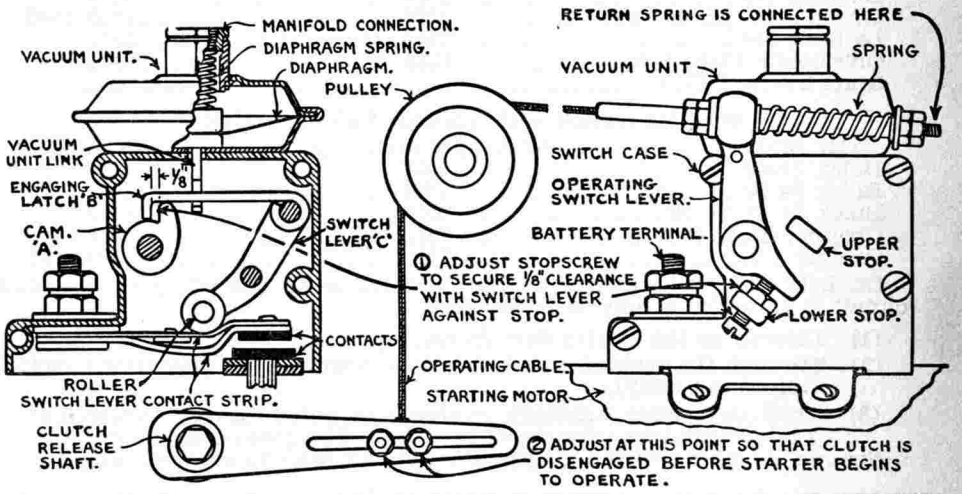
ADJUSTMENT:—The starting switch assembly should be adjusted as follows:

(1) Operating lever position. Adjust stop screw below operating lever so that switch lever is 5° plus or minus ½° past the vertical position with the lever against the stop screw. This setting can be checked by measring distance from center of switch lever to edge of switch case (see illustration). This distance should be 1 19/32" with correct setting. Clearance between switch lever and upper stop lug must be at least 1/16" after initial contact is made on new switches.

(2) Control rod spring tension should be adjusted so that spring is not compressed more than ⅛" before starting to close switch contacts. This spring is compressed after switch contacts are closed to permit full clutch pedal travel. Check clutch pedal operation and see that spring is not compressed solidly under any conditions.

Adjust switch operating cable linkage so that switch is closed as soon as clutch is disengaged. Test as follows to determine if clutch pedal travel is too great, or if switch operates before clutch is disengaged:

(1) **Switch operates before clutch is disengaged.** Place car in gear. Do not turn ignition on. Slowly depress clutch pedal until starting switch closes. If car has a tendency to move, clutch is not fully released. Loosen cable clamp on switch lever on clutch throw-out shaft, move clamp toward shaft to decrease cable travel. Tighten clamp and repeat test.



(2) **Clutch pedal travel is excessive.** Place car in gear. Turn on ignition. Depress clutch pedal until switch contacts are closed and engine starts. Slowly release clutch pedal until clutch begins to engage (engine take hold), note clutch pedal travel. Correct by loosening cable clamp on switch lever on clutch throw-out shaft and moving clamp out or away from shaft to increase cable travel. All tests must be made with the switch operating lever return spring in place.

TROUBLE SHOOTING:—If switch action is unsatisfactory, check following points:

(1) **Engine does not start when clutch pedal is depressed.** Check starting motor cable and connections at switch and battery. See that switch operating lever return spring is in place. Check switch and operating linkage adjustment (see Adjustment above).

(2) **Switch operates whenever clutch is disengaged.** Check vacuum line and connections. Replace vacuum unit.

DELCO-REMY STARTER CONTROLS

SOLENOID SWITCH, TYPES 1512, 1513, 1514, 1515, 1516, 1517, 1518, 1519, 1521

DESCRIPTION:—These starting switches are all of the combined starting switch and pinion shift type. The starting switch solenoid is controlled by a solenoid relay mounted within the solenoid switch case on the starter field frame. The relay is remotely controlled by a push button switch on the instrument panel, or by a vacuum switch operated by the accelerator pedal or throttle lever. In most cases the solenoid relay circuit feed wire is connected to the coil side of the ignition switch so that the starting system is operative only with the ignition turned on. Starter control types used on 1934 car models are as follows:

Solenoid Switch with Pushbutton Control

Car Model	Solenoid Switch Type	Pushbutton Switch Type
Cadillac V-8 355-D	1519, 1521	1319
Cadillac V-12, 16 370-D, 452-D	1515	1379
Chrysler Cust. Imp. CW	1518	.....
De Soto SE	1516	1387
Graham 68, 67, 69 (all)	1517	1388, 1386
La Salle 350	1516	1379
Oldsmobile Eight L-34	1514	1385
Stutz SV-16, DV-32	.....	.....

Solenoid Switch with Vacuum Switch Control

Car Model	Solenoid Switch Type	Vacuum Switch Type
Buick 34-40	1512	1594
Buick 34-50	1513	1587
Buick 34-60, 34-90	1512	1587
Chrysler Eight & Imp. CU, CV	1516	1592
Pontiac	1513	1583, 1593

On both the pushbutton type and vacuum swith control type, the relay circuit is grounded in one of three ways:

(1) Directly to the starter field frame.

(2) Through the generator main brushes (connected to generator terminal of cutout relay).

(3) Through special auxiliary contacts mounted directly above cutout relay armature (these contacts open when main contacts close).

See individual car wiring diagrams for circuit used on each car model.

OPERATION:—When the pushbutton switch is closed, or the accelerator pedal is depressed (vacuum switch type), with the ignition turned on, the soleoid relay circuit is completed, energizing the relay and closing the relay contacts. This completes the solenoid circuit. The solenoid plunger is drawn into the coil, meshing the starter pinion, and closing the starting switch contacts. When the engine begins to fire, the solenoid relay circuit is broken in one or more of the following ways:

(1) Operation of the vacuum switch. Caused by the vacuum built up in the intake manifold.

(2) By the rise in generator voltage. Where solenoid relay is grounded through generator main brushes or auxiliary contacts in cutout relay, the voltage built up by the generator opposes the current flow through the solenoid relay winding.

(3) By releasing the pushbutton switch. On De Soto, Graham, and other installations where solenoid relay is grounded directly to starter field frame, the circuit will not be broken until the pushbutton is released.

(4) By the opening of the ground contacts. Where solenoid relay is grounded through auxiliary contacts in cutout relay, these contacts open when generator begins to charge and main contacts close. See (2) above.

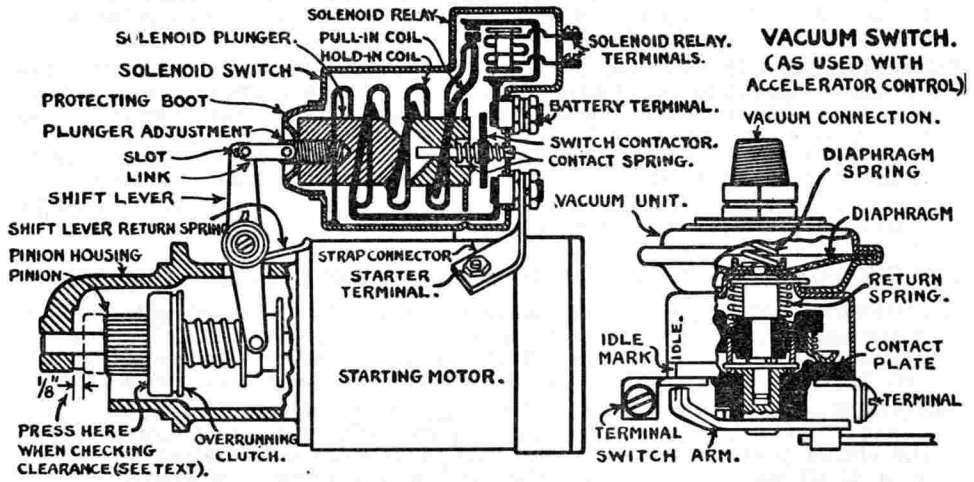
When the solenoid relay circuit is broken, the relay contacts open, breaking the solenoid circuit. The starting pinion is demeshed by the shift return spring and the starting switch contacts are opened by the contact spring.

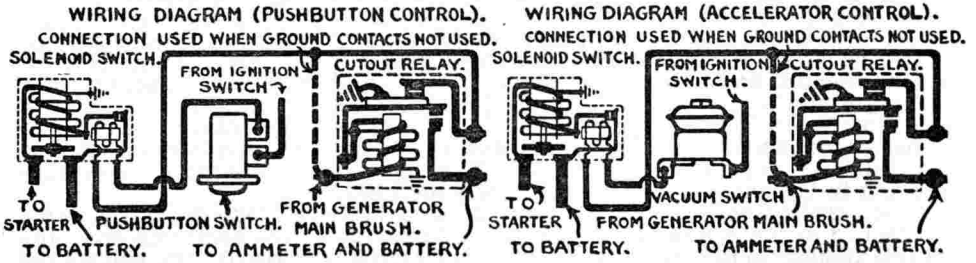
ADJUSTMENT:—Solenoid Switch. There is only one adjustment on the solenoid switch. Clearance between the end of the pinion and the starting motor drive housing should be ⅛" with shift plunger at inner end of stroke. Remove starter from car, take out all lash in overrunning clutch by pressing on clutch shell before checking clearance. Adjust by taking out pin in shift lever and turning adjusting stud in or out of shift plunger. With correct adjustment, clearance should be ⅛" with plunger bottomed in switch case and adjusting stud linkage pin against near end of shift lever slot (see illustration).

Solenoid Relay—Relay contacts should close with maximum terminal voltage of 4.0 volts and should remain closed until terminal voltage drops to 1.6-2.0 volts. If relay operation is unsatisfactory, check contact gap and air gap.

Solenoid Relay Contact Gap—.030-.045".

Air Gap—.010-.014" (contacts closed).





Where the solenoid relay circuit is grounded through auxiliary ground contacts in the cutout relay, the contact gap for these contacts should be .015-.025" (main contacts closed). If starting system does not operate, see that these contacts are in good condition and closed. If main contacts stick or do not open, check cutout relay as directed on car data sheets. Where solenoid relay circuit is grounded through generator main brushes, check condition of generator armature. Armature must be kept clean and free from oil.

Vacuum Switch. The only adjustment of the vacuum switch is the 'off' position (accelerator pedal released—engine not running). The correct position of the vacuum switch lever is indicated by a line on the switch case and linkage should be adjusted so that the pointer of the lever is opposite this line. See data below for adjustment of linkage on individual car models. In operation, the manifold vacuum disengages the switch clutch drive tangs and clutch plate. The contact plate assembly is then returned to the original 'off' position by the return spring. The switch can not be operated again until the engine stops and the accelerator pedal is returned to the 'off' position.

DELCO-REMY STARTER CONTROLS

VACUUM SWITCH (ACCELERATOR LINKAGE) ADJUSTMENT

Buick Model 34-40. Warm up engine (water temperature should be 140°F.). Close hand throttle (push button in), check idling speed, adjust to correct 'hot' or slow idling speed of 8 M.P.H. Check accelerator pedal position (distance from top of pedal to floor should be 2 29/32"—adjust by changing length of pedal rod). Rotate 'fast' or cold idle control cam on carburetor counterclockwise until it is against the stop, see that cam remains in this position while vacuum switch adjustment is being made. Disconnect vacuum switch operating rod at vacuum switch, rotate switch lever until pointer lines up with line on case marked 'Fast Idle', adjust rod length so that it can be connected to switch lever without disturbing position of lever. Check operation of starter and see that gap between idle adjustment screw and throttle opening cam on carburetor is at least 7/32" at the instant when vacuum switch makes contact and operates starting motor.

Buick Models 34-50, 60, 90. Warm up engine (water temperature should be 140°F.). Check idling speed, adjust to correct 'hot' or slow idling speed of 8 M.P.H. See that throttle rod shoulder is screwed up as close as possible to the trunnion on the throttle valve lever, check accelerator pedal position. Distance from top of accelerator pedal to floor should be 4⅛" (50), 4⅜" (60), 4⅝" (90). Adjust by disconnecting accelerator pedal rod and changing position of trunnion on lower end. Rotate cold idle control cam clockwise by hand until it is against the stop, see that cam remains in this position while vacuum switch adjustment is being made. Take out cotter pin in lower end of vacuum switch lever operating rod, turn switch lever so that pointer lines up with line marked 'Fast Idle' on switch case, adjust rod length by turning rod in or out of switch lever trunnion until lower end of rod can be inserted in hole in lower bell crank without disturbing position of switch lever. Check operation of starter and see that gap between idler adjustment screw and throttle opening cam is at least 3/32" at the instant when vacuum switch makes contact and operates starting motor.

Chrysler Airflow Eight and Imperial Eight Models CU, CV. See that accelerator pedal is in idle position, disconnect vacuum switch operating rod at switch, turn switch lever so that pointer lines up with line marked 'idle' on switch case, vary length of operating rod by turning adjustable link on switch end of rod until rod can be coupled to switch lever without disturbing position of lever. Hold 'fast idle' on carburetor in 'off' position, adjust screw on throttle bell crank directly to rear of vacuum switch so that there is 3/16" play or lost motion in throttle linkage. With this setting, throttle should be ¼-1/3 open at the instant the vacuum switch makes contact and operates the starting motor.

Pontiac Eight. Adjust rod connecting bell cranks on side of engine block so that accelerator pedal just touches floor board with carburetor throttle valve wide open. Release accelerator pedal and with throttle valve in closed position, set adjusting screw in lever at forward end of this connecting rod so that clearance between this lever and lever which operates carburetor throttle valve rod is .235-.265" (use gauge #J-635-1). Disconnect vacuum switch operating rod at switch lever, turn switch lever so that pointer lines up with line on switch body, adjust length of rod by turning trunnion on rod until rod can be connected to switch lever without disturbing position of lever. See that hand throttle is fully closed, loosen set screw in throttle cable trunnion (at lower end of cable), adjust cable length so that clearance between lever at forward end of hand throttle operating rod and carburetor throttle valve rod lever is 1/32" minimum (use gauge #J-635-2). Check setting after opening and closing hand throttle. These clearances are important.

SYNCHROSCOPE (NEON LIGHT) IGNITION TIMING

DESCRIPTION:—This device consists of a Neon light which is clipped to #1 spark plug terminal so that the light flashes whenever the spark plug fires. When this light is used to illuminate the flywheel timing mark by being directed at the flywheel housing inspection hole, it gives a stroboscopic effect so that the timing mark appears to be standing still while the engine is being idled. This allows the ignition timing to be checked and set with the engine running.

OPERATION:—Clip one Synchroscope lead terminal to #1 spark plug terminal (on Buick cars with spark plugs covered by shield, disconnect #1 cable at distributor, clip one lead to this cable, insert other lead in #1 terminal on distributor cap). Ground the other Synchroscope lead to the engine. Remove cover plate over inspection hole in flywheel housing, mount Synchroscope so that light is directed at flywheel, inspect flywheel ignition mark (if mark is not distinctive and is likely to be confused with others, fill in mark with white paint or chalk so as to be easily discernible). Start engine and allow to idle at specified speed (do not exceed this speed). If flywheel mark does not appear to be opposite pointer or reference line on flywheel housing, loosen distributor clamp bolt and advance or retard spark until mark is directly in line with pointer. Tighten clamp bolt and remove Synchroscope.

RADIO INSTALLATION

ANTENNA:—All closed car models are now fitted with a roof antenna. This type antenna should be used wherever possible although plate or under-car antennas have been used with some success, and occasionally metal tire covers, insulated trunk racks, trunks, etc., have been used. The type antenna to be installed on older car models will depend upon the type of roof construction encountered. On cars with poultry wire reinforcement, this wire can be used for the antenna if it is cleared of all grounds and is cut back at least 3″ from all metal portions of the car roof and from the dome light and dome light wiring. Poultry wire which is not bonded or soldered at all points where the wire is crossed or twisted together will not make as satisfactory an antenna and the wire should be cut back and a copper-screen antenna installed.

Copper-screen Antenna. The copper screen used should be a good grade #14 or #16 mesh. It should be cut to fit the entire top, allowing 3″ clearance from metal portions of the roof and around the dome light. The screen should be tacked on the side of the roof bows to which the headlining is fastened. The entire front edge should be bonded or soldered and a lead-in of #18 gauge stranded copper, rubber covered, lead-in wire soldered to one corner. In most cases the lead-in can be taken down the hollow right or left front corner post and need be shielded only from a point within the lower end of the post. The lead-in should never be run in the same post with the dome light wiring. The antenna should always be made as large as possible even though it is possible to secure good reception with the newer sets using a smaller antenna under ordinary conditions.

Laced Wire or Grid Type Antenna. On cars with metal roof bows, where the copper-screen type antenna cannot be used, #16 rubber-covered antenna wire should be laced crosswise between the roof bows. It will be possible to install an antenna of 65-100 feet in length in this manner, keeping the wire at least 3″ away from each metal bow and from the dome light and dome light wiring. A simple way of supporting the antenna wire consists of tacking cord loops 3″ long between the bows along each side of the roof. The antenna lead-in can then be run through these cord loops along one side of the roof and the antenna wire soldered to the lead-in at each point where it crosses from side to side.

False Top Antenna for Open Cars. A simple manner of installing an antenna in open cars consists of assembling a false top containing the antenna and then tacking this in place below the top but above the roof bows. The false lining should be slightly narrower than the top and the lead-in should be connected at one of the rear corners if the top is intended to be lowered. The antenna can be made of a piece of cooper screen with a light weight felt on either side and all encased in a cover of drill cloth selected to match the top, or may be made of rubber covered antenna wire laid out to form a grid and stitched to the drill cloth covering.

Testing Antenna:—After installing antenna, or after cutting back poultry wire tops so that they may be used for this purpose, test antenna for grounds, using a sensitive voltmeter and a dry cell, preferably a 45-volt 'B' battery. Clip one voltmeter terminal to the antenna lead-in. Connect the other voltmeter terminal to the battery and ground the battery to the car. Any voltmeter reading indicates a ground which should be eliminated. In making this test, the leads should be fastened, using clips or screw terminals—they should not be held by hand.

STANDARD INTERFERENCE SUPPRESSION:—The usual practice in eliminating motor interference consists in installing spark plug suppressors or resistors in the center terminal of the distributor and at each spark plug and connecting a condenser at the generator and the ignition coil (a filter is sometimes used in the primary circuit) as detailed below. In most cases this completely eliminates motor interference, but on a number of cars certain features of design and wiring require additional suppression. Details of the means devised to overcome interference picked up at these other points are given in the special section below.

Shielding. The number of cables to be shielded and the amount of shielding required depends on the design of the set. In all cases where provision is made for shielding cables connected to the set, this shielding must be grounded (pigtails are usually provided with terminals which can be connected to the set case or the car). The battery feed cable for the set is always shielded and should be grounded at each end. This cable should be connected to the battery side of the ammeter (interference may be caused by connecting the cable to the car side of the ammeter) or may be taken down to the battery and connected directly to the ungrounded battery terminal if interference is found when the cable is connected at the ammeter.

Spark Plug and Distributor Suppressors. These suppressors consist of carbon resistors which are connected in each spark plug cable at the spark plugs (in some cases where it is not possible to mount these on the spark plugs, distributor type suppressors have been plugged in each of the distributor cap terminals). A suppressor is also plugged in the center terminal on the distributor cap and the high tension lead from the coil connected to it (on Ford V-8 where the ignition coil is integral with the ignition unit, this suppressor cannot be used, the spark plug suppressors will be sufficient).

Generator Condenser. The condensers furnished for this purpose are generally grounded through the case and should be mounted under one of the generator relay mounting screws so that a ground is provided. The lead should be connected to the generator side of cutout relay.

Ignition Condenser or Filter. These condensers are usually of the same type as used on the generator and are grounded through the mounting bracket. The lead should be connected to the switch side of the ignition coil (primary terminal). If two leads are provided, one lead should be grounded. Filters when used are connected in series with the coil primary. In some cases reversing the coil primary terminal connections has reduced interference.

SPECIAL INTERFERENCE SUPPRESSION:—Dome Light. Dome light wiring is the source of considerable interference pick-up. This may be eliminated by connecting a condenser to the dome light lead at the point where it enters the corner post, or at the ammeter, or by connecting a filter in the dome light circuit at the ammeter. The dome light lead in the top can also be shielded by wrapping the lead with strips of foil and fastening the end of the foil strip to a grounded screw in the top. The dome light wiring should never be enclosed in the same corner post with the antenna lead-in.

High and Low Tension Wiring. High tension ignition cable should not be run near or within the same conduit as the lighting or low tension wires (on some cars the generator wire, horn lead, etc., will be found in the spark plug cable conduit). These wires should be removed and reinstalled outside the conduit.

Peening Distributor Rotor. This practise is not recommended by a number of car manufacturers but can be resorted to where excessive clearance is found on old car models and it is not desired to replace the rotor and distributor cap. Clearance between rotor and segments in distributor cap should be .003-.005″. To check clearance, apply a heavy coat of chalk to the inner face of each segment in distributor cap, replace cap (do not fasten hold-down clamps), crank engine by hand to rotate distributor rotor, note whether chalk is disturbed on any segment, then hold rotor flat on anvil, use a light hammer to peen rotor tip until it is elongated slightly (dress down sides with a file to retain original rotor contour), replace and test. If rotor is found to disturb chalk on one or two segments, file the face of these segments lightly so that gap will be uniform on all segments.

Shielded High Tension Cables. High tension cables should not be shielded. If ignition coils are located under the cowl or in the front compartment, and interference results, the coils should be relocated and if possible mounted on the engine side of the dash. On cars with coil-lock type ignition switches, where it is not possible to relocate the coil, the high tension lead between the coil and the dash can be shielded if the interference cannot be eliminated in any other manner. Replace the high tension lead with new cable. Install a piece of loom extending one inch from the coil terminal to a point about 1½ inches through the dash, wrap the loom with copper braid shielding, ground the copper braid to the dash.

Bonding of Controls, etc. In some cases interference will be lessened if the metal dash or front compartment bulkhead is bonded by a braided cable to the engine block. This is particularly important on cars with rubber engine mountings. Controls such as spark advance levers can be grounded by soldering a wire to the control and the car frame, allowing sufficient slack for the operation of the control. Metal conduits or control cable housings passing through the dash should be grounded by wrapping a wire securely around cable and fastening it under a grounded screw head. This is important on late model cars with these cables insulated from the dash by rubber grommets or insulating washers.